Minimum Rates and Classifications for Building Construction

**Connecticut Department of Labor**
**Wage and Workplace Standards Division**

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>Hourly Rate</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters.<strong>See Laborers Group 7</strong></td>
<td>43.72</td>
<td>30.99</td>
</tr>
<tr>
<td>1c) Asbestos Worker/Heat and Frost Insulator</td>
<td>43.72</td>
<td>30.99</td>
</tr>
<tr>
<td>2) Boilermaker</td>
<td>38.34</td>
<td>26.01</td>
</tr>
<tr>
<td>3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons</td>
<td>36.18</td>
<td>34.59 + a</td>
</tr>
<tr>
<td>3b) Tile Setter</td>
<td>34.9</td>
<td>25.87</td>
</tr>
<tr>
<td>3c) Terrazzo Mechanics and Marble Setters</td>
<td>31.69</td>
<td>22.35</td>
</tr>
<tr>
<td>3d) Tile, Marble &amp; Terrazzo Finishers</td>
<td>26.7</td>
<td>21.75</td>
</tr>
<tr>
<td>3e) Plasterer</td>
<td>33.48</td>
<td>32.06</td>
</tr>
</tbody>
</table>

-----LABORERS-----

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>Hourly Rate</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>4) Group 1: Laborers (common or general), acetylene burners, concrete specialists, wrecking laborers, fire watchers.</td>
<td>31.5</td>
<td>23.25</td>
</tr>
<tr>
<td>4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman (Person running mixer and spraying fireproof only).</td>
<td>31.75</td>
<td>23.25</td>
</tr>
</tbody>
</table>

**As of:** January 18, 2022
**High School Kitchen, Cafeteria and Music Suite Renovations (Granby)**

### 4b) Group 3: Jackhammer operators/pavement breaker, mason tender (brick), mason tender (cement/concrete), forklift operators and forklift operators (masonry).

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>32.0</td>
<td>23.25</td>
</tr>
</tbody>
</table>

### 4c) Group 4: Pipelayers (Installation of water, storm drainage or sewage lines outside of the building line with P6, P7 license) (the pipelayer rate shall apply only to one or two employees of the total crew who primary task is to actually perform the mating of pipe sections) P6 and P7 rate is $26.80.

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>32.5</td>
<td>23.25</td>
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</table>

### 4d) Group 5: Air track operator, sand blaster and hydraulic drills.

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>32.25</td>
<td>23.25</td>
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</tbody>
</table>

### 4e) Group 6: Blasters, nuclear and toxic waste removal.

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>34.5</td>
<td>23.25</td>
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</tbody>
</table>

### 4f) Group 7: Asbestos/lead removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped).

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<thead>
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<tbody>
<tr>
<td>32.5</td>
<td>23.25</td>
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</table>

### 4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew.

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>29.78</td>
<td>23.25</td>
</tr>
</tbody>
</table>

### 4h) Group 9: Top men on open air caisson, cylindrical work and boring crew.

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>29.24</td>
<td>23.25</td>
</tr>
</tbody>
</table>

### 4i) Group 10: Traffic Control Signalman

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18.0</td>
<td>23.25</td>
</tr>
</tbody>
</table>


<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>35.57</td>
<td>25.65</td>
</tr>
</tbody>
</table>

### 5a) Millwrights

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>35.64</td>
<td>26.49</td>
</tr>
</tbody>
</table>

### 6) Electrical Worker (including low voltage wiring) (Trade License required: E1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>40.75</td>
<td>30.47+3% of gross wage</td>
</tr>
</tbody>
</table>

### 7a) Elevator Mechanic (Trade License required: R-1,2,5,6)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>56.96</td>
<td>35.825+a+b</td>
</tr>
</tbody>
</table>

### ----LINE CONSTRUCTION----

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundman</td>
<td>26.5</td>
</tr>
<tr>
<td>Linemen/Cable Splicer</td>
<td>48.19</td>
</tr>
<tr>
<td>Glazier (Trade License required: FG-1,2)</td>
<td>39.98</td>
</tr>
</tbody>
</table>

As of: January 18, 2022
### High School Kitchen, Cafeteria and Music Suite Renovations (Granby)

<table>
<thead>
<tr>
<th>Operators</th>
<th>Group 1: Crane handling or erecting structural steel or stone, hoisting engineer 2 drums or over, front end loader (7 cubic yards or over), work boat 26 ft. and over and Tunnel Boring Machines. (Trade License Required)</th>
<th>43.88</th>
<th>25.80 + a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2:</td>
<td>Cranes (100 ton rate capacity and over); Excavator over 2 cubic yards; Piledriver ($3.00 premium when operator controls hammer); Bauer Drill/Caisson. (Trade License Required)</td>
<td>43.53</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 3:</td>
<td>Excavator; Backhoe/Excavator under 2 cubic yards; Cranes (under 100 ton rated capacity), Grader/Blade; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar); Grader Operator; Bulldozer Fine Grade. (slopes, shaping, laser or GPS, etc.). (Trade License Required)</td>
<td>42.72</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 4:</td>
<td>Trenching Machines; Lighter Derrick; Concrete Finishing Machine; CMI Machine or Similar; Koehring Loader (Skooter).</td>
<td>42.3</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 5:</td>
<td>Specialty Railroad Equipment; Asphalt Paver; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24)</td>
<td>41.65</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 5 continued:</td>
<td>Side Boom; Combination Hoe and Loader; Directional Driller; Pile Testing Machine.</td>
<td>41.65</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 6:</td>
<td>Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).</td>
<td>41.31</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 7:</td>
<td>Asphalt roller, concrete saws and cutters (ride on types), vermeer concrete cutter, Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24)</td>
<td>40.94</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 8:</td>
<td>Mechanic, grease truck operator, hydroblaster; barrier mover; power stone spreader; welding; work boat under 26 ft.; transfer machine.</td>
<td>40.51</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 9:</td>
<td>Front end loader (under 3 cubic yards), skid steer loader regardless of attachments, (Bobcat or Similar): forklift, power chipper; landscape equipment (including Hydroseeder).</td>
<td>40.04</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 10:</td>
<td>Vibratory hammer; ice machine; diesel and air, hammer, etc.</td>
<td>37.81</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 11:</td>
<td>Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment.</td>
<td>37.81</td>
<td>25.80 + a</td>
</tr>
</tbody>
</table>

### As of: January 18, 2022
<table>
<thead>
<tr>
<th>Group</th>
<th>Title</th>
<th>Hourly Rate</th>
<th>Overage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 12</td>
<td>Wellpoint operator.</td>
<td>37.74</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 13</td>
<td>Compressor battery operator.</td>
<td>37.11</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 14</td>
<td>Elevator operator; tow motor operator (solid tire no rough terrain).</td>
<td>35.87</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 15</td>
<td>Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.</td>
<td>35.43</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 16</td>
<td>Maintenance Engineer/Oiler.</td>
<td>34.72</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 17</td>
<td>Portable asphalt plant operator; portable crusher plant operator; portable concrete plant operator.</td>
<td>39.42</td>
<td>25.80 + a</td>
</tr>
<tr>
<td>Group 18</td>
<td>Power safety boat; vacuum truck; zim mixer; sweeper; (Minimum for any job requiring a CDL license).</td>
<td>36.77</td>
<td>25.80 + a</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-----PAINTERS (Including Drywall Finishing)------</td>
</tr>
</tbody>
</table>

| 10a) | Brush and Roller | 36.42 | 22.90 |
| 10b) | Taping Only/Drywall Finishing | 37.17 | 22.90 |
| 10c) | Paperhanger and Red Label | 36.92 | 22.90 |
| 10e) | Blast and Spray | 39.42 | 22.90 |
| 11)  | Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9, J-1,2,3,4, SP-1,2) | 45.83 | 33.50 |
| 12)  | Well Digger, Pile Testing Machine | 37.26 | 24.05 + a |
| 13)  | Roofer (composition) | 38.9 | 21.85 |
| 14)  | Roofer (slate & tile) | 39.4 | 21.85 |
| 15)  | Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6) | 40.08 | 40.53 |
| 16)  | Pipefitter (Including HVAC work) (Trade License required: S-1,2,3,4,5,6,7,8, B-1,2,3,4, D-1,2,3,4, G-1, G-2, G-8 & G-9) | 45.83 | 33.50 |

As of: January 18, 2022
**Project:** High School Kitchen, Cafeteria and Music Suite Renovations (Granby)

------TRUCK DRIVERS------

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Rate</th>
<th>Sub-Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>17a</td>
<td>2 Axle</td>
<td>30.16</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>17b</td>
<td>3 Axle, 2 Axle Ready Mix</td>
<td>30.27</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>17c</td>
<td>3 Axle Ready Mix</td>
<td>30.33</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>17d</td>
<td>4 Axle, Heavy Duty Trailer up to 40 tons</td>
<td>30.39</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>17e</td>
<td>4 Axle Ready Mix</td>
<td>30.44</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>17f</td>
<td>Heavy Duty Trailer (40 Tons and Over)</td>
<td>30.66</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>17g</td>
<td>Specialized Earth Moving Equipment (Other Than Conventional Type on-the-Road Trucks and Semi-Trailers, Including Euclids)</td>
<td>30.44</td>
<td>27.16 + a</td>
</tr>
<tr>
<td>18</td>
<td>Sprinkler Fitter (Trade License required: F-1,2,3,4)</td>
<td>47.55</td>
<td>26.60 + a</td>
</tr>
<tr>
<td>19</td>
<td>Theatrical Stage Journeyman</td>
<td>25.76</td>
<td>7.34</td>
</tr>
</tbody>
</table>

*As of:* January 18, 2022
High School Kitchen, Cafeteria and Music Suite Renovations (Granby)

Welders: Rate for craft to which welding is incidental.
*Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.
**Note: Hazardous waste premium $3.00 per hour over classified rate

### ALL Cranes: When crane operator is operating equipment that requires a fully licensed crane operator to operate he receives an extra $4.00 premium in addition to the hourly wage rate and benefit contributions:

1. **Crane handling or erecting structural steel or stone; hoisting engineer (2 drums or over)**
2. **Cranes (100 ton rate capacity and over)** Bauer Drill/Caisson
3. **Cranes (under 100 ton rated capacity)**

<table>
<thead>
<tr>
<th>Crane Description</th>
<th>Extra Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane with 150 ft. boom (including jib)</td>
<td>$1.50 extra</td>
</tr>
<tr>
<td>Crane with 200 ft. boom (including jib)</td>
<td>$2.50 extra</td>
</tr>
<tr>
<td>Crane with 250 ft. boom (including jib)</td>
<td>$5.00 extra</td>
</tr>
<tr>
<td>Crane with 300 ft. boom (including jib)</td>
<td>$7.00 extra</td>
</tr>
<tr>
<td>Crane with 400 ft. boom (including jib)</td>
<td>$10.00 extra</td>
</tr>
</tbody>
</table>

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol. For those without internet access, please contact the division listed below.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

Contracting Agencies are under no obligation pursuant to State labor law to pay any increase due to the annual adjustment provision.

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

As of: January 18, 2022
Project: High School Kitchen, Cafeteria and Music Suite Renovations (Granby)

--Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: January 18, 2022
**Important Information:**
For use with Building, Heavy/Highway, and Residential

Welders: Rate for craft to which welding is incidental.

*Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.

**Note: Hazardous waste premium $3.00 per hour over classified rate.

**ALL Cranes:** When crane operator is operating equipment that requires a fully licensed crane operator to operate he receives an extra $4.00 premium in addition to the hourly wage rate and benefit contributions:

1) Crane handling or erecting structural steel or stone; hoisting engineer (2 drums or over)
2) Cranes (100 ton rate capacity and over) Bauer Drill/Caisson
3) Cranes (under 100 ton rated capacity)

- **Crane with boom including jib, 150 feet - $1.50 extra.**
- **Crane with boom including jib, 200 feet - $2.50 extra.**
- **Crane with boom including jib, 250 feet - $5.00 extra.**
- **Crane with boom including jib, 300 feet - $7.00 extra.**
- **Crane with boom including jib, 400 feet - $10.00 extra.**

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

- Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of one apprentice in a specific trade.

**Connecticut General Statute Section 31-55a:** Annual Adjustments to wage rates by contractors doing state work

- The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.
- Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.
- It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.
- The annual adjustments will be posted on the Department of Labor's Web page: [www.ctdol.state.ct.us](http://www.ctdol.state.ct.us).
- The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.
- All subsequent annual adjustments will be posted on our Web Site for contractor access.
Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage.

- All Persons who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.
- All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)
- Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Type of the Contract.
   3. Work sequences.
   4. Work under other contracts.
   5. Owner-furnished products.
   6. Use of premises.
   7. Owner's occupancy requirements.
   8. Work restrictions.

B. Related Sections include the following:
   1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Granby Memorial High School

1. Project Location: 315 Salmon Brook Street, Granby CT. 06035

2. Owner: Town of Granby.


B. The Work consists of the following:

1. The Work includes, but is not limited to, Interior renovations to the Cafeteria and Music Areas of the building. The work will include, but not be limited to selective demolition, new construction including concrete work, and new floors, walls and ceilings, doors and frames and aluminum storefront. It also includes new finishes and acoustical treatments, kitchen equipment and Fire Sprinklers, Plumbing, HVAC, Electrical all as indicated and described in the Bid Documents. Limited Sitework includes excavation and backfill, concrete paving, concrete block retaining wall, fencing and new propane storage tanks.

2. The building has been tested and there is no evidence of hazardous materials in the work areas.
1.3 TYPE OF CONTRACT

A. This project will be performed under a single prime contract utilizing the AIA 104 Standard Abbreviated Form of Agreement between Owner and Contractor.

1.4 WORK UNDER OTHER CONTRACTS

A. Concurrent Work: Owner may award separate contract(s) for the construction operations at Project site. Those operations may be conducted simultaneously with work under this Contract.

1. Cooperate fully with Owner’s separate contractor(s) so work on those contract(s) may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under Owner’s separate contracts.

B. Future Work: Owner may also award separate contract(s) for the additional work to be performed at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1.7 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to areas within the Contract limits for each task indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.

2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.8 OWNER’S OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

3. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

4. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed within the contract limit line, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Where applicable, Obtain a Certificate of Partial Occupancy from authorities having jurisdiction before Owner occupancy.

2. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed.

3. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.9 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed during hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, except otherwise indicated.

1. Weekend Hours: shall be as approved by Owner.

2. Early Morning Hours: shall be as approved by Owner.

3. Hours for Utility Shutdowns: shall be as approved by Owner.

4. Hours for noisy activity: shall be as approved by Owner.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

1.10 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 2004 CSI "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

   a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION ***
SECTION 01 31 13
PROJECT COORDINATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Requests for Information (RFIs).
3. Project management software.

B. Related Requirements:

1. Division 01 Section "Project Meetings" administrative and procedural requirements for the Project Meetings; for coordination meetings.
2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner or Architect, seeking information required by or clarifications of the Contract Documents.

1.4 SUBMITTALS

A. Trade and Non-Trade Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A or similar as approved by Architect. Include the following information in tabular form:

1. Name, address, and office telephone and cellular numbers of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
B. Key Personnel Names: 7 days prior to Pre-Construction Meeting, submit a list of key personnel assignments, including project manager, superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, office telephone and mobile phone numbers, and e-mail addresses. Provide names, addresses, telephone and mobile numbers, and e-mail addresses of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in field office.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections,

   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
   b. Digital Data Software Program: Drawings are available in Revit.
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Architect.
1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents submit an RFI to the Architect.

1. Architect will not respond to RFIs that are not submitted through the General Contractor.

2. Coordinate and submit RFIs in a prompt manner to avoid unnecessary work and delays.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. General Contractor’s signature.
12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation and/or additional information.
   a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or similar software-generated form with substantially the same content as indicated above, acceptable to Architect. Format to be Adobe Acrobat PDF format.

D. Architect’s Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect’s response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day. Architect’s action may include a request for additional information, in which case Architect’s time for response will date from time of receipt of additional information.

2. Architect’s action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures”.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Use software log that is part of Project Web site. Software log with not less than the following:

1. Project name and project number.
2. Name and address of Construction Manager.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Construction Manager disagrees with response.

A. On completion of Project, provide one each complete archive copy of Project record files to Owner and to Architect in a digital storage format acceptable to Architect.

B. Contractor shall provide a web-based project management application software packages under their current published licensing agreements. The application shall provide flexibility to access construction project data 24/7 and through a variety of interfaces and devices, including but not limited to desktop, web, and mobile, online or offline. The software shall provide tracking of RFIs, responses to RFI’s Potential Change Orders, Change Orders, and Submittals. Project Reports shall also be retained in the file. Provide access to the project management software for Owner's project manager, Architect, the architect’s consultants.

PART 2 - PRODUCTS
[Not Used]

PART 3 - EXECUTION
[Not Used]

END OF SECTION
***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
      1. Start Date meeting (establishes start date)
      2. Pre-construction conferences.
      3. Pre-installation conferences.
      4. Progress meetings.
      5. Safety
      6. Coordination
      7. As-built drawings review
      8. And as required
   B. Related Sections: The following Sections contain requirements that relate to this Section:
      1. Division 01 Section 01 31 13 "Project Coordination" for procedures for coordinating project meetings with other construction activities.
      2. Division 01 Section 01 32 16.13 "CPM Schedules" for requirements for CPM scheduling and reporting progress of work.
      3. Division 01 Section 01 33 00 "Submittal Procedures" for submitting the Construction Schedule or CPM Schedule.

1.3 PRE-CONSTRUCTION CONFERENCE
   A. The Contractor will attend a pre-construction conference before starting construction, as scheduled by the Construction Administrator convenient to the Owner, the Construction Administrator, Architect, and Contractor. This meeting will take place at least fourteen (14) days prior to official Start Date. Hold the conference at the Project Site or another convenient location as directed by the Construction Administrator. The Construction Administrator shall conduct the Pre-construction Conference to review the Contractor and Subcontractor responsibilities and personnel assignments.
   B. Attendees: Authorized representatives of the Construction Administrator, Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; agency; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
   C. Agenda: Discuss items of significance that could affect progress, including the following:
      1. Tentative construction schedule.
      2. Critical work sequencing.
      3. Progress meeting schedule.
      4. Designation of responsible personnel.
5. Procedures for processing field decisions and Change Orders.
6. Procedures for processing Applications for Payment.
8. Submittal of Shop Drawings, Product Data, and Samples.
10. Use of the premises.
11. Parking availability.
12. Office, work, and storage areas.
13. Equipment deliveries and priorities.
15. First aid.
17. Housekeeping.
18. Working hours.
19. Coordination with Audio Visual and Telecommunications.

1.4 PRE-INSTALLATION/CONSTRUCTION CONFERENCES

A. The Contractor will schedule a pre-installation conference(s) at the Project Site before each construction activity that requires coordination with other construction. The Contractor shall be responsible to notify in writing the Construction Administrator and the appropriate Subcontractor(s), etc., of the date and time of all Pre-installation/Construction Conferences. Notification shall be at least seven (7) days, prior to the Conference. The Contractor shall be responsible for coordination and attendance of all Subcontractors, etc., involved in or affected by the installation for all Pre-installation/Construction Conferences.

B. Attendees: The Construction Administrator, Contractor, Subcontractors, Owner and Architect, the installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. The Contractor shall advise all attendees of the scheduled Pre-installation/Construction Conferences dates.

C. Review the progress of other construction activities and preparations for the particular activity under consideration at each Pre-installation/Construction Conference, including but not limited to the following requirements:

   2. Options.
   3. Related Change Orders.
   4. Purchases.
   5. Deliveries.
   6. Shop Drawings, Product Data, and quality-control samples.
   7. Review of mockups.
   8. Possible conflicts.
  10. Time schedules.
  12. Manufacturer's recommendations.
13. Warranty requirements.
15. Acceptability of substrates.
16. Temporary facilities.
17. Space and access limitations.
18. Governing regulations.
20. Inspecting and testing requirements.
22. Recording requirements.
23. Protection.

D. The Construction Administrator will record significant discussions and agreements and disagreements of each Pre-installation/Construction Conference, and the approved schedule. The Construction Administrator will promptly distribute the record of the Preinstallation/Construction Conference to all attendees.

E. The Contractor shall not proceed with the installation/construction if the conference cannot be successfully concluded. The Contractor shall be responsible to initiate whatever actions are necessary to resolve impediments to performance of Work and schedule and reconvene another Pre-installation/Construction Conference at the earliest feasible date. Failure of the contractor to resolve impediments to the performance of the work will not result in an extension of days.

1.5 PROGRESS MEETINGS

A. The Construction Administrator will conduct progress meetings, bi-weekly, at the Project Site or at regular intervals as agreed upon at the Pre-construction Conference. The Construction Administrator will notify the Owner, the Architect, and the Contractor of the scheduled Progress Meeting dates. Coordinate dates of Progress Meetings with preparation of Application for Payment requests.

B. Attendees: In addition to representatives of the Contractor, Construction Administrator, Owner and the Architect, subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities may be requested to attend these meetings on an as needed basis. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work. The Contractor shall include the site superintendent as a minimum.

C. Agenda: Progress Meetings shall review and correct or approve minutes of the previous Progress Meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

1. Construction Schedule or CPM Schedule: Review progress since the last Progress Meeting. Determine where each activity is in relation to the required Contractor's "Construction Schedule" or "CPM Schedule" and whether each activity is on time or ahead or behind Schedule. Determine how Work that is behind Schedule will be expedited; secure commitments from parties involved to do so. Discuss whether Schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including the following:
   a. Interface requirements.
   b. Time.
   c. Sequences.
d. Status of submittals.
e. Deliveries.
f. Off-site fabrication problems.
g. Access.
h. Site utilization.
i. Temporary facilities and services.
j. Hours of work.
k. Hazards and risks.
l. Housekeeping.
m. Quality and work standards.
n. Change Orders.
o. Documentation of information for payment requests.

D. Reporting: The Construction Administrator will distribute minutes of the meeting to each party present, promptly and before the next scheduled meeting, and to parties who should have been present.

1.6 SUBCONTRACTOR/COORDINATION/SAFETY MEETINGS

A. The Contractor shall conduct Subcontractor/coordination meetings.

B. The Contractor shall conduct a separate safety meeting after the safety plan is submitted. The Contractor shall take meeting minutes. These minutes shall be made available upon request. The Contractor shall notify the Construction Administrator of the times and dates of these meetings, who may elect to attend these meetings as an observer when necessary. A minimum of one safety meetings will be held per month.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

***
SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for submittals required for
performance of the Work, including but not limited to the following:
1. Submittal schedule.
2. Shop Drawings.
3. Product Data.
4. Samples.
5. Quality assurance submittals.
6. Proposed "Substitutions/Equals".
7. Warrantee samples.
8. Coordination Drawings.
9. O & M Manuals
B. Administrative Submittals: Refer to other Division 01 Sections and other Contract Documents
for requirements for administrative submittals. Such submittals include, but are not limited to,
the following:
1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Contractor’s construction schedule.
5. Daily construction reports.
7. Insurance certificates.
8. List of subcontractors.
9. Subcontractors/Suppliers FEIN #’s and Connecticut tax registration #.
C. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 01 Section 01 31 19 "Project Meetings” specifies requirements for submittal and
distribution of meeting and conference minutes.
2. Division 01 Section 01 45 00 "Quality Control" specifies requirements for submittal of
inspection and test reports and mockups.
3. Division 01 Section 01 35 46 "Indoor Air Quality Management" specifies requirements for
submittal of documentation required to support high performance building requirements.
4. Division 01 Section 01 77 00 "Closeout Procedures" specifies requirements for submittal
of Project Record Documents and warranties at project closeout.
5. Division 01 Section 01 78 30 "Warranties and Bonds".
6. Division 01 Section 01 91 13 “General Commissioning Requirements” specifies requirements for submittal of quality assurance documentation related to commissioning.

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specification Divisions 02 through 49.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

   a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

   b. The Architect reserves the right to reject incomplete submitted packages.

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

   a. Allow at least fourteen (7) calendar days for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals, or the submittal must be reviewed by the Architect’s corresponding engineer consultants.

   b. If an intermediate submittal is necessary, process the same as the initial submittal.

   c. Allow at least fourteen (7) calendar days for reprocessing each submittal.

   d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Web-Based Construction Administration Database:

1. For the entire Construction Period, the General Contractor shall provide, manage and maintain a High-Band Width Electronic File Transfer Service that is accessible via the Internet by a Web Browser such as Internet Explorer or Goggle Chrome. The General Contractor shall process submittals electronically, through one of the following web-based construction administration database services:

   a. Procore.

   b. Submittal Exchange.

   c. Newforma.

   d. Or equal.
2. The General Contractor shall provide licensed seats/access to, and training on said database, for all of the Architect’s Consultant’s and, to facilitate electronic transmittal of all of Construction Documentation including, but not limited to Project submittals, RFI’s and Change Order Requests, Proposal Requests, Architect Supplemental Information, Meeting Minutes, and Architect Field Reports.

3. All of the Project documentation compiled in this CA database, shall be made completely accessible to the Architect & Owner, for the entire duration of the Project, and then be submitted (in PDF form) to, and become the property of the Owner, similar to all other Closeout documentation related to this Project.

4. Distribution:
   a. General Contractor shall electronically deliver submittals to the Architect and its consultants, and in a format acceptable to the Architect.
   b. (For submittals that are 11x17 and larger) simultaneously, General Contractor shall deliver 1 hard copy print each to the Architect and its consultants.
   c. Architect and consultants will review submittals, and the Architect will post reviewed submittals on web-based file transfer service specified herein.
   d. General Contractor is responsible for distribution to all trades.
   e. Drawings submitted directly from Subcontractors, manufacturers or vendors, or directly to the Architect’s consultants, will be returned to the General Contractor without action.
   f. General Contractor shall meet with Architect to develop list of submittals, required to be sent to Town agencies (fire department, building inspector, engineering department), and submit required submittals and shop drawings to appropriate agencies at same time as submittals to other team members.

C. Submittal Preparation: Place a permanent label, title block or 8-1/2 inches x 11 inches cover page approved by the Architect, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. The minimum number of copies required for each submittal shall be seven (7) or as determined otherwise at the pre-construction conference or by the Construction Administrator.

2. Provide a space approximately 4 inches by 5 inches on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor’s review, approval markings, the action taken and signature.

3. Include the following information on the label for processing and recording action taken.
   a. Project Name and State of Connecticut Project Number.
   b. Date.
   c. Name and address of the Architect, Construction Administrator, and Owner Representative.
   d. Name and address of the Contractor.
   e. Name and address of the subcontractor.
   f. Name and address of the supplier.
   g. Name and address of the manufacturer.
   h. Number and title of appropriate Specification Section.
   i. Drawing number and detail references, as appropriate.
   j. Indicate either initial or resubmittal.
   k. Indicate deviations from Contract Documents.
GRANBY MEMORIAL HIGH SCHOOL RENOVATIONS
GRANBY, CT

I. Indicate if "equal" or "substitution".

D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling.

Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor. Copy the Construction Administrator on the transmittal. After action is taken, the Architect and his consultant (where applicable) will each retain one complete copy of the submittal package and will return one complete copy of the submittal package to the Contractor. The Contractor shall make copies from this submittal package and distribute it to all trades affected for coordination.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor’s certification that information complies with Contract Document requirements.

1.6 SUBMITTAL SCHEDULE

A. After development and review by the Owner and Architect acceptance of the Contractor’s CPM schedule prepare a complete schedule of submittals. Submit the schedule to the Construction Administrator within 30 calendar days of Contract Award.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor’s CPM Schedule.

2. Prepare the schedule in chronological order. Provide the following information:
   a. Schedule date for the initial submittal.
   b. Related section number.
   c. Submittal category (Shop Drawings, Product Data, or Samples).
   d. Name of Subcontractor.
   e. Description of the part of Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for the Architect’s final release of approval.

B. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by CPM schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor’s CPM schedule.

2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 calendar days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor’s construction schedule.
   a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each specification section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same specification section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows.
   Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow at least 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals, or review by the Architect's consultant is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination with related submittals not yet received. Additional time will be required if processing must be delayed to permit review of related subsequent submittals.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow at least 7 calendar days for review of each resubmittal.

4. Mass Submittals: Six (6) or more submittals in one (1) day or 20 or more submittals in one (1) week. If "Mass Submittals" are received, Architect's review time stated above may be extended as necessary to perform proper review. Architect will review "Mass Submittals" based upon priority determined by Architect after consultation with Construction Administrator and Contractor.

E. Distribution: Following response to the initial submittal, the Contractor shall print and distribute copies to the Construction Administrator, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

F. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording, at the minimum, the following information concerning events at the site, and submit duplicate copies to the Construction Administrator at weekly intervals:

1. List of subcontractors at the site.

2. Approximate count of personnel at the site.

3. High and low temperatures, general weather conditions.

4. Accidents and unusual events.

5. Meetings and significant decisions.

7. Meter readings and similar recordings.
8. List of equipment on site and identify if idle or in use.
9. Orders and requests of governing authorities.
10. Change Orders received, start and end dates.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completion authorized.
15. Equals or Substitutions approved or rejected.

1.8 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following minimum information:
   1. Dimensions.
   2. Identification of products and materials included by sheet and detail number.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.
   6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
   7. Submit one (1) reproducible original with seven (7) prints as directed by the Construction Administrator. The Contractor's submittal shall identify the specification section and/or drawing number applicable to the submittal.
   8. Details shall be large scale and/or full size.

C. The Contractor shall review the Shop Drawings, sign and stamp with his approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in his Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the submission, the Contractor shall inform the Architect, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.

D. The Architect will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of the General Conditions. Shop Drawings received by the Architect that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.

E. The Contractor shall make any corrections required by the Architect and shall resubmit the required number of corrected copies of Shop Drawings until fully reviewed.

F. Upon final review submit four (4) additional prints, same as submitted, for use by the Construction Administrator.
G. The Architect's review and comments on Shop Drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents. H. Only final reviewed Shop Drawings are to be used on the Project site.

I. The Work installed shall be reviewed in accordance with the Shop Drawings and the drawings and specifications. Final Review of the Shop Drawings by the Architect shall constitute acceptance by the State and the Architect of a variation or departure that is clearly identified. If the contractor believes notations made by the A/E affects the value or scope of the Work, the Contractor must provide written notice to the CA within 7 calendar days of this issue. Final reviewed Shop Drawings shall not replace or be used as a vehicle to issue or incorporate change orders or substitutions. Substitutions shall be submitted in accordance with Division 01 Section 01 25 00 "Substitution Procedures".

1.9 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
   a. Manufacturer's printed recommendations.
   b. Compliance with trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.
   f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.

4. Submittals: Submit seven (6) copies of each required submittal. The Architect and his engineer will each retain one (1) and will return the other marked with action taken and corrections or modifications required.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
1. Store, mount or display Samples on site in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following: 
   a. Specification Section number and reference.
   b. Generic description of the Sample.
   c. Sample source.
   d. Product name or name of the manufacturer.
   e. Compliance with recognized standards.
   f. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
   a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.
   b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
   c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
   d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices, unless otherwise noted in specification section.
   a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three (3) sets. The Architect will return one (1) set marked with the action taken.

5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
   b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
   a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.
1.11 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section 01 45 00 "Quality Control."

1.12 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal "Approved" the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When the Architect marks a submittal "Approved as Noted" the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.

3. Returned for Resubmittal: When the Architect marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

   a. Do not use, or allow others to use, submittals marked "Rejected, or Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Required."

C. Unsolicited Submittals: The Architect will discard unsolicited submittals without action.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS
A. General: Basic contract definitions are included in the General Conditions of the Contract for Construction.
B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the reader locate the reference. Location is not limited to this term.
C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.
D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
F. "Furnish": The term "furnish" means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
G. "Install": The term "install" describes operations at the Project Site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.
I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
   1. The term "experienced," when used with the term "installer," means having a minimum of five (5) previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of authorities having jurisdiction.
   2. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
   3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their
assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

J. "Project Site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction, with others performing other Work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on CSI's "MasterFormat" 49-Division format and numbering system.

B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated, as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Streamlined Language: The Specifications generally use the imperative mood and streamlined language. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

a. The words "shall be" are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents unless a specific date is indicated in the Contract Documents or the governing regulations cited herein.

C. Conflicting Requirements: Where compliance with two (2) or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent and highest quality requirement. Request a decision from the Architect before proceeding on requirements that are different but apparently equal, and where it is uncertain which requirement is the most stringent.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum acceptable. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as
appropriate, for the context of the requirements. Request a clarification from the Architect regarding uncertainties before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Thompson Gale’s “Encyclopedia of Associations,” available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project Site to be available for reference by parties who have a reasonable need during submittals, planning, and progress of the Work, until Substantial Completion.

11. Americans with Disabilities Act (ADA).
13. SMACNA Guidelines for IAQ for occupied buildings under construction.

1.6 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner’s records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for quality-control services.
B. Quality-Control services include fire alarm acceptance testing, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by the Owner.
C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
   1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
E. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for development of a schedule of required tests and inspections.
   2. Division 01 Section 01 77 00 "Closeout Procedures", specific requirements for contract closeout procedures.
   3. Division 28 Section 28 31 00 "Fire Detection and Alarm" specifies field quality control for the Alarm System.

1.3 RESPONSIBILITIES
A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, the Owner, through the Construction Administrator, shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. All tests required by the individual specification sections are required to be scheduled and notification given to the Construction Administrator 24 hours in advance of the test/inspection as applicable. Costs for these services are not included in the Contract Sum.
   1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
   2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
a) Such services include Special Inspections as required by the latest edition of the "Connecticut State Building Code".

b) Where the Owner has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector, as a representative of the Owner, shall document and confirm compliance with the provisions of the Connecticut State Building Code for Special Inspections.

c) Materials and assemblies for this project will be tested and construction operations inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the State for final acceptance.

d) The Owner's use of testing and inspection services shall in no way relieve the Contractor of the responsibility to furnish materials and finished construction in full compliance with the Contract Documents and the Connecticut State Building Code.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated non-compliance with Contract Document requirements.

2. The Owner will issue a credit change order to cover all costs incurred related to all retests/re-inspections due to non-compliance to the Contract Documents, including but not limited to the Owner's costs and the Consultant's costs.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the Agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide an approved design mix proposed for use for material mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Construction Administrator, Architect and the Contractor in performance of the testing agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The testing agency shall notify the Construction Administrator and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. The testing agency shall not perform any duties of the Contractor.

E. Owner will pay for the services of an independent testing agency laboratory to perform inspections, tests and other services required by the Specifications except as noted below,
listed for which the Owner will issue a deduct change order to cover the cost associated with these tests:

1. When the Contractor notifies the Construction Administrator and/or Testing Agency less than 24 hours before the expected time of testing.
2. When the Contractor requires testing for his own convenience.
3. When the Contractor schedules a test and is not ready for the required test.

F. Submit reports of tests that are part of the submittal requirements which indicate compliance or non-compliance with the specified standard.

G. See also General Conditions Article 16 "Inspections & Tests".

H. Fire Alarm/Acceptance Testing Procedures:

1. For buildings exceeding the threshold limit, the fire alarm testing shall be as the authority having jurisdiction shall dictate. This will be as determined by the State Fire Marshals Office.

2. For buildings that do not exceed the threshold limit, the fire alarm testing shall be as the authority having jurisdiction shall dictate. This will be determined by the Department of Public Works requirements as set below:


   b. Prior Test Notification: At least five (5) working days prior to testing, the Fire Alarm Contractor shall notify (in writing) the following people of the proposed date the acceptance tests are to be performed (Also, see Part 2 of Certificate of Compliance).
      - Department of Public Works Team Representative
      - General Contractor
      - Engineer of Record
      - Equipment Supplier Representative
      - Sprinkler Contractor

   c. Certificates of Compliance:
      1) A Fire Alarm System Inspection and Testing Certification and Description form shall be prepared for each system (See NFPA 72/2002 Chapter 7 and Figure 75.2.2).

      2) Parts 1 and 3 through 9, shall be completed after the system is installed and the installation of the wiring has been checked. Every alarm device must also be pre-tested to ensure proper operation and correct annunciation at each remote annunciator and control panel. Part 1 of the form (Certification of System Installation) shall be signed by the fire alarm contractor. The signed and completed preliminary copies of the Certification form shall be forwarded to all parties along with the Prior Test Notification.

      3) Part 2, of each applicable form, shall be completed after the operational tests have been completed.

      4) After the completion of the operational acceptance tests and sign-off of test witness (with stipulations noted), final copies of the Certificates shall be forwarded to the Department of Public Works Representatives.

   d. Tests:
1) All tests shall be conducted in accordance with the Manufacturer’s Testing Recommendations.

2) All testing equipment, apparatus (i.e. sound level decibel meter, 2-way radio communication, test devices, ladders, tools, lighting, etc.) and personnel shall be supplied by the Fire Alarm Contractor and Sprinkler Contractor.

e. System Documentation: Every system shall include the following documentation, which shall be delivered to the Department of Public Works Representatives upon final acceptance of the system. An owner's manual or manufacturer's installation instructions covering all system equipment, including the following:

1) A detailed narrative description of the system inputs, evacuation signaling, ancillary functions, annunciation, intended sequence of operations, expansion capability, application considerations, and limitations.

2) Operator's instructions for basic systems operations including alarm acknowledgment, system reset, interpreting system output (LED’s CRT display, and printout), operation of manual evacuation signaling and ancillary function controls, changing printer paper, etc.

3) A detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed. This information should include:

   (a) A listing of individual system components that require periodic testing and maintenance.

   (b) Step by step instructions detailing the requisite testing and maintenance procedures and the intervals at which those procedures should be performed.

   (c) A schedule that correlates the testing and maintenance procedures required by paragraph (2) above and with the listing required by paragraph (1) above.

4) Detailed troubleshooting instructions for each type of trouble condition recognized by the system, including opens, grounds, parity errors, "loop failures," etc. These instructions should include a list of all trouble signals, and step by step instructions describing how to isolate those problems and correct them (or call for service as appropriate).

5) A service directory, including a list of names and telephone numbers for those who should be called to service the system.

f. As-Built Drawings:

1) The Contractor will produce two (2) sets of as-built drawings and specifications for the fire alarm system, indicating the location (and programmed address, if applicable) of all devices and appliances, the wiring sequences, wiring methods, connection of the components, and sequence of operation of the protective signaling system as installed, shall be given to DPW representatives. This shall be in Accordance with NFPA 72. Refer also to Section 01 77 00 "Closeout Procedures".

1.4 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Construction Administrator. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
   a. Date of issue.
   b. Project title and number.
   c. Name, address, and telephone number of testing agency.
   d. Dates and locations of samples and tests or inspections.
   e. Names of individuals making the inspection or test.
   f. Designation of the Work and test method.
   g. Identification of product and Specification Section.
   h. Complete inspection or test data.
   i. Test results and an interpretation of test results.
   j. Ambient conditions at the time of sample taking and testing.
   k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
   l. Name and signature of laboratory inspector.
   m. Recommendations on re-testing.

1.5 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are pre-qualified as complying with the National Voluntary Laboratory Accreditation Program and that specialize in the types of inspections and tests to be performed.

   1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

B. Protect constructions exposed by or for quality-control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION

***
SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for testing laboratory services required for the Project.

B. Contractor and subcontractors shall cooperate with independent testing firm(s); furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

1. Notify Architect and independent firm 48 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

C. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum.

1.02 REQUIREMENTS

A. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

B. In addition to the Contract's testing, the Owner reserves the right, at his sole discretion, to select and pay for the services of an independent Testing Laboratory to perform specified services and testing as may be in the Owner's best interest.

C. Contractor shall cooperate with the laboratory to facilitate the execution of its services.

1.03 RELATED REQUIREMENTS

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

   Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities.

1. Respective sections of specifications: Certification of products.

2. Section 07 26 19 – TOPICAL MOISTURE VAPOR MANAGEMENT SYSTEM.

1.04 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1.05 LABORATORY DUTIES

A. Cooperate with Architect and Contractor; provide qualified personnel promptly on notice.

B. Acquaint Owner, Architect, and Contractor's superintendent with testing procedures and with all special conditions encountered at the site.

C. Inspections, sampling, and testing of materials and construction methods shall be as specified in individual technical specification sections.
   1. Comply with specified standards, ASTM, ANSI, and other recognized authorities.
   2. Conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state any deviations therefrom.
   3. Obtain Contractor's written acknowledgment of each inspection, sampling, and test made.

D. Promptly notify Architect, Owner's Project Manager and Contractor of irregularities or deficiencies of Work or Products which are observed during performance of services.

E. Promptly submit written report of each test and inspection; one copy each to Architect, Owner, Project Manager, Building Commissioner, Contractor, and one copy to Project Record Documents File. Each report shall include:
   1. Date issued.
   2. Project title and number.
   3. Testing laboratory name, address, and telephone number.
   4. Name and signature of laboratory inspector.
   5. Date and time of sampling or inspection.
   6. Record of temperature and weather conditions.
   7. Date of test.
   9. Location of sample or test in the Project.
   10. Type of inspection or test.
   11. Results of tests and compliance with Contract Documents.
   12. Interpretation of test results, when requested by Architect.

F. Perform properly authorized additional services as required by the Owner.

1.06 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:
   1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Approve or accept any portion of the Work, except as specifically authorized by the specifications.
   3. Perform any duties of the Contractor.
1.07 CONTRACTOR’S RESPONSIBILITIES

A. Coordinate and cooperate with laboratory personnel, provide access to Work, and to Manufacturer’s operations.

1. Monitor each inspection, sampling, and test.
2. Provide Laboratory or Agency with written acknowledgment of each Inspection, sampling, and test.
3. Within 24 hours notify Architect and Owner in writing of reasons for not acknowledging Laboratory results.

B. Secure and deliver to the Laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the Laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.

D. Furnish copies of Product test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to Work to be tested.
2. To obtain and handle samples at the Project site or at the source of the Product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Furnish verification of materials and equipment compliance with Contract Documents.

G. Identify materials to be tested or inspected by Testing Laboratory or Agency.

H. After determination of need for testing or inspecting by Owner, notify Laboratory a minimum five days in advance of operations, to allow for its assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor’s negligence.

I. Arrange with the laboratory and pay for additional samples and tests required:

1. For the Contractors convenience; or
2. When initial tests indicate Work does not comply with Contract Documents.

1.08 CONDUCT OF INSPECTIONS AND TESTS

A. The Contractor shall notify the Owner, Architect, and Testing Laboratory a minimum of 48 hours before the performance of work to permit the proper conduct of Owner-authorized inspections and tests.

B. Representatives of Testing Laboratory shall inspect the manufacture, assembly, and placement of materials as required and as authorized by the Owner, and report their
findings to the Architect, Resident Project Representative, Owner, and Contractor.

C. Work may be checked as it progresses, but failure to detect any defective work or materials may in no way prevent later rejection when such defect is discovered, nor does it obligate the Owner to accept such work.

D. Contractor’s Responsibilities: The Contractor shall notify the Owner, Architect, Project Manager, and Testing Laboratory personnel at least 48 hours prior to performance of work requiring testing. The Contractor shall fully cooperate with testing agencies and always permit free access to all areas. The Contractor shall permit taking samples at any time during construction, either before or after installation. Prior to notice to proceed with construction, the Contractor shall submit a Testing Log of planned tests and scheduled test dates. Tests shall be numbered based on type of work, type of test, and sequence. The Testing Log shall be maintained by the Contractor in the field office and updated weekly.

1. Coordination: The Contractor shall coordinate all testing, including all testing and inspections to be paid for by the Owner. The Contractor will arrange testing and sampling performed by the Owner’s testing agency and will have prepared test record forms. Upon receipt of test results, the Lab will distribute copies with test results as follows:

   a. Contractor: 1 copy.
   b. Architect: 3 copies.

E. Follow-up and Corrective Action: The Contractor will note the test record on the Testing Log to acknowledge test procedures and results. If follow-up or corrective action is needed, the Contractor shall submit to the Architect two written copies of proposed follow-up or corrective plans and obtain the Architect’s written approval before proceeding.

1. Cost of Testing: If tests indicate that materials or work do not comply with requirements, the Contractor shall pay for all retesting, and shall remove and replace non-complying work at no additional cost to the Owner.

1.09 SCHEDULE OF TESTING AND LABORATORIES BY OWNER

A. Except as otherwise specified, Owner will appoint, employ, and pay for services of independent firm(s) to perform inspection and testing and other services specified herein, in individual specification Sections, and as additionally required by the Architect.

B. General Construction Tests: More detailed testing requirements are given in individual Specification Sections. The Owner shall retain the right to make any additional tests the Architect deems necessary or appropriate. The Contractor is responsible for providing his own tests to determine that materials meet specified requirements. The scope of tests required and paid for by the Owner (unless otherwise noted below) may include as a minimum the following:

   1. Earthwork: Lab tests to determine suitability of all fill materials shall be paid for by the Contractor. Owner reserves the right to retain and pay for his own testing for checking purposes.

   2. Earthwork: Proctor tests for compaction.

   3. Concrete Paving and General Concrete Work: Concrete mix design testing shall be paid for by the Contractor. Owner reserves the right to retain and pay for his own testing for checking purposes.
4. Concrete Paving and General Concrete Work: Concrete test cylinders as specified in Section 03 30 00 – CAST-IN-PLACE CONCRETE.

5. Sealant: Chemical analysis; adhesive strength; compatibility with adjacent materials; elasticity.


C. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

1. Testing agency will notify Architect, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor and to authorities having jurisdiction.

3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

5. Testing agency will retest and reinspect corrected work.

1.10 SCHEDULE OF TESTING AND LABORATORIES BY SUB-CONTRACTOR

A. Sub-Contractor shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified under this Article and as additionally in individual specification sections.

1. Submit to Architect/Engineer a qualified independent testing laboratory for each type of testing specified by individual specification sections and those required by the referenced applicable codes, regulations and standards.

2. Employment of testing laboratory shall in no way relieve Sub-Contractor of obligation to perform work in accordance with requirements of Contract Documents.

B. Moisture and pH testing of concrete floors:

1. Perform moisture and pH tests on concrete slabs as follows. The test shall be witnessed by the Sub-Contractor’s Superintendent, appropriate flooring or coating subcontractor, and Project Manager.
   a. Sub-Contractor shall Perform moisture and pH tests on all concrete floors over which a floor coating or sealer is to be applied.

   2). Section 09 65 10 – RESILIENT FLOORING AND ACCESSORIES.

   4). Section 09 67 23 – RESINOUS FLOORING.

   b. Sub-Contractor shall Perform moisture and pH tests on all concrete floors over which a floor coating or sealer is to be applied.

2. Requirements:
   a. Perform tests on new and existing concrete floor slabs.
1). Areas to be tested shall include floors at grade level.

2). DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.

   b. Perform testing after the floor slabs have been prepared and leveled, unless testing is required for the application of floor preparation materials.

3. Test Type:
   a. Moisture Testing:
      1). Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements.
   b. pH Testing
      1). pH test paper and distilled water.

4. Testing Procedures:
   a. Initial testing: Provide 3 tests for the first 1,000 square feet.
   b. Add one test for each additional 1,000 square feet.
   c. Concrete surface area to be tested shall be completely clean. Remove all adhesives, residue, debris and sealing compounds. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
   d. Perform moisture tests in strict accordance with the kit manufacturer's instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
   e. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
   f. After completion of tests submit two (2) copies of test data to the Architect. Submit one (1) copy of test data to the installers of all flooring materials or coating materials scheduled to be installed.
   g. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

C. Local Authority Inspections: The Contractor is also responsible for coordinating and cooperating with local requirements for inspections by local Authorities.

D. Respective subcontractors shall employ and pay for services of an approved independent testing laboratory to perform inspection and testing specified under this Article and as additionally in individual specification sections.

   1. Submit to Architect/Engineer a qualified independent testing laboratories for each type of testing specified by individual specification sections and those required by the referenced applicable codes, regulations and standards.
   2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

E. Plumbing: At least the following tests shall be performed. Conform to requirements specified in individual Division 15 Specification Sections. The test will be performed and paid for by the subcontractor and witnessed by the Contractor's Project Superintendent, Project Manager and authorities having jurisdiction:

   1. Water supply piping hydrostatic pressure test.
2. Sanitary piping test before fixture installation: Cap pipes and fill to highest point in system.

3. Plumbing fixture operation.

F. Fire Protection System: At least the following tests shall be performed. Conform to requirements specified in individuals Division 15 Specifications Sections. The test shall be performed and paid for by the Field-subcontractor and witnessed by the Contractor' Project Superintendent and Project Manager and authorities having jurisdiction:

1. Fire Protection system flushed, and pressure tested.

G. HVAC Testing: All HVAC work shall be tested by an independent testing and balancing agency, approved by Owner. Conform to requirements specified in individual Division 15 Specification Sections. The tests shall be performed and paid for by the subcontractor and witnessed by the Contractor Project Superintendent, Project Manager and authorities having jurisdiction. Adjustments shall be made by the subcontractors directed by the Owner. At least the following tests shall be performed:

1. Piping hydrostatic tests.
2. Air and water balancing.
3. Thermostat control monitoring and testing.

H. Electrical Power System Testing: At least the following tests shall be performed. Conform to requirements specified in individual Division 16 Specification Sections. The tests shall be performed and paid for by the Electrical Subcontractor and witnessed by the Contractor' Project Superintendent, Project Manager and authorities having jurisdiction:

1. Polarity tests.
2. Operation of all circuits.
3. Testing of emergency system.
4. Security systems.
5. Grounding systems.
6. Voice/Video/Data networking testing.

I. Electrical Lighting System Testing: Conform to requirements specified in individual Division 16 Specification Sections. At least the following tests shall be performed and paid for by the Electrical Subcontractor and witnessed by the Contractor’ Project Superintendent, Project Manager and authorities having jurisdiction:

1. Operation of every component of entire system.

J. Fire Alarm System Testing: At least the following tests will be performed. Conform to requirements specified in individual Division 16 Specification Sections. The test shall be performed and paid for by the subcontractor and witnessed by the Contractor’ Project Superintendent, Project Manager and authorities having jurisdiction:

1. All smoke and heat detectors.
2. Proper operation as required by authorities having jurisdiction.
PART 2 – PRODUCTS

(Not Used)

PART 3 – EXECUTION

(Not Used)

END OF SECTION

***
PART 1 - GENERAL

1.1 GENERAL PROVISION
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section 01 33 00 "Submittal Procedures" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
   2. Division 01 Section 01 42 20 "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.

1.3 DEFINITIONS
A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
   1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
      a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, which is current as of the date of the Contract Documents.
   2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
   3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 QUALITY ASSURANCE
A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
B. Compatibility of Options: When the Contractor is given the option of selecting between two (2) or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING
A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
   1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Store products in accordance with manufacturers' instructions and maintain within temperature and humidity range required by manufacturer.
   4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
   5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
   6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
   7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation.
   8. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
   9. Store loose granular material on solid surfaces in a well-drained area; prevent mixing with foreign matter.
   10. Arrange storage to provide access for inspection. Periodically inspect to ensure products are undamaged and are maintained under required conditions. Keep log showing date, time and problems, if any.
   11. Stone, masonry units and similar materials shall be stored on platforms or dry skids and shall be adequately covered and protected against damage.
   12. Materials and equipment shall be delivered, stored and handled to prevent intrusion of foreign matter and damage by weather or breakage. Packaged materials shall be delivered and stored in original, unbroken packages.
   13. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct, and products are undamaged.
   14. Packages, materials, and equipment showing evidence of damage will be rejected and replaced at no additional cost to the Owner.
PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
   1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
   1. Semi-proprietary Specification Requirements: Where Specifications name two (2) or more products or manufacturers, provide one (1) of the products indicated. Comply with the requirements of Division 01 Section 01 25 00 "Substitution Procedures."
   2. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
   3. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
   4. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

2.2 INTERIOR FINISHES

A. Interior finishes, trim and decorative materials shall comply with the State of Connecticut Building Code, Chapter 8, requirements pertaining to flame spread and smoke developed for Use Groups as defined on the Documents.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
   1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

***
SECTION 01 73 00
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Examination.
2. Preparation.
3. Construction layout.
4. Field engineering and surveying.
5. Installation of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Protection of installed construction.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 01 11 00 - Summary of Work: for limits on use of Project site.
2. Section 01 33 00 - Submittal Procedures: for submitting surveys.
3. Section 01 73 29 - Cutting and Patching: for requirements of executing cutting and patching.
4. Section 01 74 19 - Construction Waste Management and Disposal*: for requirements of executing construction waste management and disposal.
5. Section 01 77 00 - Closeout Procedures: for requirements of executing final cleaning.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor and/or professional engineer.

B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for any discovered hazardous waste disposal.
1.5 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

[Not Used.]

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground plumbing and electrical services, and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, roofs, and other substrates for suitable conditions where products and systems are to be applied or installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.

4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted practices.
   1. Establish benchmarks and control points to set lines and levels at construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

3.5 INSTALLATION OF THE WORK

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of [96 inches (2440 mm)] <Insert dimension> in occupied spaces and [90 inches (2300 mm)] <Insert dimension> in unoccupied spaces.

B. Comply with manufacturer’s written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Non-Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 COORDINATION OF OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to the work area for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal".

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration until Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Comply with manufacturer's written instructions for temperature and relative humidity.

B. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration until date of Substantial Completion.
   1. Repair, restore, or replace, if not repairable, all damaged work at no cost to the Owner.

END OF SECTION
EXECUTION REQUIREMENTS
01 73 00 - 5
PROJECT No. 056-0052 A / 01/07/2022
PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. This Section includes procedural and execution requirements for cutting and patching. Contractor shall be responsible for all cutting and patching including but not limited to:

1. Provide cut openings in elements of the Work, and the patching of the same, for openings required by all trades.
2. Uncover work to provide access for installing and/or inspecting of ill-timed work.
3. Remove and replace non-conforming work or as otherwise determined to be defective.

B. Coring and Drilling:

1. Coring or drilling of holes up to 8" in diameter and incidental to the work of individual trade shall be performed by the trade requiring the penetration.
2. General Contractor shall be responsible for coring or drilling of holes larger than 8" in diameter.
3. General Contractor shall be responsible for coordination of all coring or drilling and patching of all weather-protection elements and exposed-to-view components affected by coring or drilling.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 01 31 13 - Project Coordination: for coordination requirements for cutting and patching.
2. Section 01 73 00 - Execution Requirements: for general requirements for execution of cutting and patching.
3. Section 07 84 00 - Firestopping: for patching fire-rated construction.
4. Divisions 02 through 34 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
1.4 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.5 SUBMITTALS

A. Make submittals in accordance with Contract Conditions and Division 01 Section "Submittal Procedures".

B. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building’s appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect’s Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.6 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include but are not limited to the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.
9. Operating systems of special construction in Division 13 Sections.
10. Safety and security systems.
11. Other elements affecting the facility's intended functional operations.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:

1. Building envelope components.
2. Water, moisture, air or vapor barriers.
3. Roof membranes and flashings.
4. Exterior fenestrations.
5. Equipment supports.
6. Piping, ductwork, vessels, and equipment.
7. Noise- and vibration-control elements and systems.
8. Sealant, caulking, firestopping, or fireproofing.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, as determined by Architect, reduce the building’s aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, General Contractor shall facilitate cutting and patching coordination conference at Project site with parties and trades performing, requesting, affecting, or affected by cutting and patching. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts to minimize the need for cutting and patching where feasible before proceeding.

1.7 WARRANTY

A. Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials recommended by manufacturer so as not to reduce or void applicable warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.
2. Remove and replace materials that has been cut and patched in a visually unsatisfactory manner as determined by Architect.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide adequate shoring, underpinning, or other sufficient temporary support for Work to be cut. Employ a qualified professional engineer to review the field conditions where necessary.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer’s written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed and adjacent areas affected. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION
***
PART 1 - GENERAL

1.1 GENERAL PROVISION
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes requirements for waste management goals, waste management plan and waste management plan implementation.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section 01 11 00 "Summary of Work".
   3. Division 01 Section 01 31 13 "Project Coordination".
   4. Division 01 Section 01 31 19 "Project Meetings".
   5. Division 01 Section 01 33 00 "Submittal Procedures".
   6. Division 01 Section 01 45 00 "Quality Control".
   7. Division 01 Section 01 50 00 "Temporary Facilities and Controls".
   8. Division 01 Section 01 60 00 "Product Requirements".
   9. Division 01 Section 01 77 00 "Closeout Procedures".
  10. Division 01 Section 01 81 13 "High Performance Buildings Compliance Requirements".

1.3 DEFINITIONS
A. Construction Waste: Solid wastes such as building materials, packaging and rubble resulting from construction, paving and infrastructure.
B. Demolition Waste: Solid wastes such as concrete, wood, brick, plaster, roofing materials, wallboard, metals, carpeting, insulation, and clean fill resulting from demolition or selective demolition of structures.
C. Recyclable Materials: Products and materials that can be recovered and remanufactured into a new product. Recyclable materials include, but are not limited to, the following:
   1. Metals (ferrous and non-ferrous), including banding, metal studs, ductwork, and piping.
   2. Asphalitic concrete paving.
   5. Paper and cardboard.
   6. Wood products, including structural, finish, crates, and pallets.
   7. Brick and masonry.
   8. Carpet and padding.
   10. Copper wiring.
D. Recycling Facility: A business that specializes in collecting, handling, processing, distributing, or remanufacturing waste materials generated by construction projects, into products or materials that can be used for this project or by others.
E. Salvage and Reuse: Existing usable product or material that can be saved and reused in some manner on the project site. Materials for reuse must be approved by the Construction
Administrator. Materials that can be salvaged and reused must comply with applicable technical specifications and include, but are not limited to, the following:

1. Dimensional lumber and other wood products.
2. Structural steel.
5. Plants.

F. Salvage for Resale: Existing usable product that can be saved and removed intact (as is) from the project site to another site for resale to others without remanufacturing.

1.4 WASTE MANAGEMENT GOALS

A. The Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors shall be employed.

B. The Contractor shall use all means available to divert the greatest extent practical and economically feasible, construction waste from landfills and incinerators.

C. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

D. Recycle and/or salvage a minimum of 50 percent of non-hazardous construction and demolition waste by weight of the total solid waste generated by the Project. The goal is to achieve 75 percent of non-hazardous construction and demolition waste.

E. With regard to these goals the Contractor shall develop, for the Construction Administrator’s review, a Waste Management Plan for this Project.

F. Take a pro-active, responsible role in management of construction waste and require all subcontractors, vendors, and suppliers to participate in the effort. Establish a construction waste management program that includes the following categories:

1. Minimizing packaging waste.
2. Salvage and reuse.
3. Salvage for resale or donation.
5. Disposal.

1.5 SUBMITTALS

A. Draft Waste Management Plan: Within 30 days after receipt of Notice of Award, or prior to any waste removal, whichever occurs sooner, the Contractor shall submit three (3) copies of a Draft Waste Management Plan to the Construction Administrator.

B. Final Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the Draft Waste Management Plan are acceptable, the Contractor shall submit within 10 days three (3) copies of a Final Waste Management Plan.

C. Progress Reports: Submit three (3) copies of monthly progress reports, at the same time as the Application for Payment, documenting the following:

1. Material category.
2. Point of waste generation.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, in tons.
5. Quantity of waste recycled, in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

D. Calculations: Submit three (3) copies of calculations indicating the end-of-project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Project prior to Substantial Completion. E. Record Submittals:

1. Donations: Indicate which salvageable materials were donated, who they were donated to, and whether the recipient is tax exempt. Submit documentation indicating receipt of donations.
2. Sales: Indicate which salvageable materials were sold, who they were sold to, and whether the recipient is tax exempt. Submit documentation indicating receipt of materials.
3. Recycling: Indicate which materials were recycled and the name of the facility licensed to accept them. Submit documentation such as manifests, weight tickets, receipts, and invoices.
4. Waste Disposal: Indicate which materials were accepted as waste by landfills and incinerator facilities licensed to accept them. Submit documentation indicating receipt of materials.

1.6 QUALITY ASSURANCE


B. Waste Management Conference: Review and discuss the waste management plan, requirements for documenting quantities of each type of waste and its disposition, procedures for materials separation, procedures for periodic collection and transportation to recycling and disposal facilities. Review waste management requirements for each trade. Verify availability of containers and bins needed to avoid delays.

1.7 WASTE MANAGEMENT PLAN

A. Draft Waste Management Plan: Include the following in the Draft Plan:

1. Analysis of the proposed jobsite waste to be generated, including types and quantities.
2. Landfill Options: The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
3. Alternatives to Landfilling: A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed local market for each material, and the estimated net cost savings or additional costs resulting from separating and recycling (versus landfilling) each material. "Net" means that the following have been subtracted from the cost of separating and recycling:
   a. Revenue from the sale of recycled or salvaged materials and
   b. Landfill tipping fees saved due to diversion of materials from the landfill. The list of these materials is to include, at a minimum, the following materials:
      1) Cardboard.
      2) Clean dimensional wood.
3) Beverage containers.
4) Land clearing debris.
5) Concrete.
6) Bricks.
7) Concrete Masonry Units (CMU).
8) Asphalt.
9) Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

B. Resources for Development of Waste Management Plan: The following sources may be useful in developing the Draft Waste Management Plan:


C. Final Waste Management Plan: The Final Waste Management Plan shall contain the following:

1. Analysis of the proposed jobsite waste to be generated, including types and quantities.
2. Landfill Options: The name of the landfill(s) where trash will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all Project waste in the landfill(s).
3. Alternatives to Landfilling: A list of the waste materials from the Project that will be separated for reuse, salvage, or recycling.
4. Meetings: A description of the regular meetings to be held to address waste management. Refer to Section 01 31 19 "Project Meetings".
5. Materials Handling Procedures: A description of the means by which any waste materials identified in item (3) above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
6. Transportation: A description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site) and destination of materials.

1.8 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.

B. Distribution: The Contractor shall distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, the Construction Administrator, and the Architect.

C. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

D. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
E. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to federal, state and local regulations.

F. Application for Progress Payments: The Contractor shall submit with each Application for Progress Payment a Summary of Waste Generated by the Project. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The Summary shall be submitted on a form acceptable to the Construction Administrator and shall contain the following information:

1. The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.

2. For each material recycled, reused, or salvaged from the Project: the amount (in tons or cubic yards), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling of each material shall be indicated. Attach manifests, weight tickets, receipts, and invoices.

PART 2 – PRODUCTS

(Not Applicable)

PART 3 – EXECUTION

3.1 PLAN IMPLEMENTATION

A. Implement the waste management plan as approved by Construction Administrator.

B. Provide training of workers, contractors, subcontracts, and suppliers on proper waste management procedures.
   1. Distribute waste management plan to all parties involved in the Project within three (3) days of submittal return.
   2. Distribute plan to parties when they first begin working on the Project site. Review plan procedures and locations established for salvage, recycling, and disposal.

3.2 SEPARATION OF RECYCLABLE WASTE MATERIALS

A. Provide the necessary containers and bins, to facilitate the waste management program, that are clearly and appropriately marked. Prevent contamination of recyclable materials from incompatible products and materials. Separate construction waste at the project site by one of the following methods:
   1. Source Separated Method: Waste products and materials, that are recyclable, are separated from trash and sorted into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Trash is transported to a landfill or incinerator.
   2. Co-Mingled Method: All construction waste is placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed and the remaining trash is transported to a landfill or incinerator.
   3. Other methods proposed by the Contractor and approved by the Construction Administrator.
PART 1 - GENERAL

1.1 GENERAL PROVISION
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operation and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section 01 11 00 “Summary of Work”.
C. Closeout requirements for specific construction activities may be included in the appropriate Sections in Divisions 02 through 48.

1.3 SUBSTANTIAL COMPLETION
A. General: Basic contract definitions are included in Article 1 of the General Conditions of the Contract for Construction.
B. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
      a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   2. Advise the Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, certificates of compliance, operating certificates, and similar releases.
   5. Submit record drawings, maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra stock, and similar items.
   7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner’s personnel of changeover in security provisions.
8. Demonstrate, thru operation and testing, the functions of all systems and/or equipment to the satisfaction of the Owner for compliance to the Contract. Complete testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

9. Complete final cleanup requirements.

10. Certify that required training of personnel is complete.

C. Inspection Procedures: The Contractor shall be ready and prepared when they request a Substantial Completion inspection. If the inspection reveals that the work is not complete, that there are extensive punch-list items that will take more than 90 days to complete and as the items listed in Article 1.3 above are not complete, the Inspection Group (consists of the Construction Administrator, Architect, and Owner) will determine the inspection has failed.

D. The Contractor is responsible for all costs to re-inspect due to a failed inspection. The Owner will issue a deduct change order to cover all costs for re-inspection.

1. The Inspection Group will repeat inspection when requested and assured that the Work is substantially complete.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for "Certificate of Acceptance" and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.

5. Submit consent of surety to Final Payment.

6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

7. Touch up and otherwise repair and restore marred, exposed finishes, including touchup painting.

B. Re-inspection Procedure: The Inspection Group will re-inspect the Work upon receipt of notice from the Construction Administrator that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.

1. Upon completion of re-inspection, the Construction Administrator will prepare a Certificate of Acceptance. If the Work is incomplete, the Construction Administrator will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
1.5 AS-BUILT DOCUMENT SUBMITTALS

A. General: The Contractor shall not use As-built Drawings for construction purposes. Protect contractor As-built Drawings from deterioration and loss in a secure, fire-resistant location. Provide access to As-built Drawings for the Architect's reference during normal working hours. Keep documents current; do not permanently conceal any work until required information has been recorded. **Failure to keep As-built Documents current is sufficient cause to withhold progress payments.**

B. As-built Drawings: The Contractor shall maintain one (1) clean, complete undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Update As-built Drawings monthly coincident with the submittal of the Application for Payment.

1. Mark record sets with erasable pencil to distinguish between variations in separate categories of the Work.
2. Mark all new information that is not shown on Contract Drawings.
3. Note related change-order numbers where applicable.
4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
5. Upon completion of the work, the Contractor shall submit Record Drawings to the Construction Administrator for the Owner's Records who will pass them on to the Architect or Engineer for transferring the changes to the Record Drawing Mylar Tracings.
6. Submit electronic format data of all Coordination Drawings as required by the Owner, at no additional cost.
7. Refer to **Section 01 45 00 "Quality Control"** Article 1.3 for required as-built drawings.

C. Record Specifications: The Contractor shall maintain one (1) complete copy of the Project Manual, including Addenda. Include with the Project Manual one (1) copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
2. Give particular attention to equals and substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
3. Note related record drawing information and Product Data.
4. Upon completion of the Work, submit Record Specifications to the Construction Administrator for the Owner's records.

D. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of Record Product Data to the Construction Administrator for the Owner's records.

E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Construction Administrator, Architect and the Owner's personnel at the Project Site to
determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Construction Administrator for the Owner’s records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinylcovered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder according to Division 01 Section 01 78 23 “Operation & Maintenance Data”. Included but not limited to the following types of information:

1. Emergency instructions.
2. Spare parts list.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.
9. Kitchen equipment

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.
B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
5. Safety procedures.
7. Effective energy utilization.

3.2 FINAL CLEANING

A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 01 Section 01 50 00 "Temporary Facilities and Controls."

B. Cleaning: Employ professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion and Certification of Occupancy.

2. Interior:
   a. Remove labels that are not permanent labels.
   b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots, wash and polish glass.
   c. Clean exposed interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
   d. Wash washable surfaces of mechanical, electrical equipment and fixtures and replace filters, clean strainers on mechanical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
   e. Clean and polish finish hardware.
   f. Clean and polish tile and other glazed surfaces.
   g. Clean floors; wax and buff resilient tile. Clean vinyl or rubber base.
   h. Vacuum and/or dust walls, ceilings, lighting fixtures, ceiling diffusers and other wall and ceiling items.
   i. Remove defacements, streaks, fingerprints and erection marks.

3. Exterior:

   a. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth, even-textured surface.
   b. Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances.
   c. Remove waste and surplus materials, rubbish and construction equipment and facilities from the site, and deposit it legally elsewhere.
d. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots, wash and polish glass.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner’s property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after completion of associated Work, they become the Owner’s property. Dispose of these materials as directed by the Construction Administrator.

2. Leave building clean and ready for occupancy. If the Contractor fails to clean up, the Owner may do so, with the cost charged to the Contractor. The Owner will issue a credit change order to cover the costs.

END OF SECTION

***
PART 1 - GENERAL

1.1 GENERAL PROVISION
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:
   1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.
   2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section 01 33 00 "Submittal Procedures" specifies preparation of Shop Drawings and Product Data.
   2. Division 01 Section 01 75 00 "Starting and Adjusting" specifies instruction of the Owner and Agency operating personnel in the operation and maintenance of building systems and equipment and the general requirements for starting-up equipment and systems.
   3. Division 01 Section 01 77 00 "Closeout Procedures" specifies general closeout requirements.
   4. Division 01 Section 01 78 30 "Warranties and Bonds" specifies requirements for submittal of warranties and bonds.
   5. Appropriate Sections of Divisions 02 through 33 specify special operation and maintenance data requirements for specific pieces of equipment or building operating systems.

1.3 QUALITY ASSURANCE
A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.
   1. Where maintenance manuals require written instructions, use professional writer skilled in technical writing where necessary for communication of essential data.
   2. Where maintenance manuals require drawings or diagrams, use professional draftsmen skilled of preparing drawings clearly in an understandable format.
B. Instructions for the Owner and Agency Personnel: The Contractor must use professional instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved, to instruct the Owner and operation and maintenance personnel.

1.4 SUBMITTALS
A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:
   1. Before Substantial Completion, when each installation that requires operation and maintenance manuals is nominally complete, submit two (2) draft copies of each manual
to the Construction Administrator for review. Include a complete index or table of contents of each manual.

a. The Construction Administrator will return one (1) copy of the draft with comments within 21 days of receipt.

b. Submit two (2) hard copies and five (5) digital copies (USB) of data in final form at least 21 days before final inspection. The Construction Administrator will return one (1) copy within 21 days after final inspection, with comments.

2. After final inspection, make corrections or modifications to comply with the Construction Administrator's comments. Submit final copies to the Construction Administrator within 21 days of receipt of the comments.

B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner and Agency's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 81/2-by-11-inch paper. Provide a clear plastic sleeve on the front and spine to hold cover and label describing contents. Provide plastic pockets in the binder to receive folded sheets.

a. Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.

b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.

2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the section on each divider.

3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclosure diagnostic software for computerized electronic equipment.

4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch, 20-lb/sq ft white bond paper.

5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.

a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.

b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

1.5 MANUAL CONTENT

A. Each manual shall contain the following information:

1. Contact information for installing contractor

2. Warranty terms
3. Troubleshooting guides
4. Product cut sheets
5. Approved shop drawings
6. Manufacturer suggested periodic maintenance requirements

B. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:
1. General system or equipment description.
2. Design factors and assumptions.
3. Copies of applicable shop drawings and product data.
4. System or equipment identification, including:
   a. Name of manufacturer, address, tech support phone number and e-mail.
   b. Model number.
   c. Serial number of each component.
5. Operating instructions.
7. Wiring diagrams.
8. Inspection and test procedures.
9. Maintenance procedures and schedules.
10. Precautions against improper use and maintenance.
12. Repair instructions including spare parts listing.
13. Sources of required maintenance materials and related services.

C. Organize each manual into separate sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of product data, supplemented by drawings and written text; and copies of each warranty, bond, and service contract issued.
1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:
   a. Subject matter covered by the manual.
   b. Name and address of the Project.
   c. Date of submittal.
   d. Name, address, and telephone number of the Contractor.
   e. Name and address of the Architect and Construction Administrator.
   f. Cross-reference to related systems in other operation and maintenance manuals.
2. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
   a. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.
3. General Information: Provide a general information section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and
the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.

4. Product Data: Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one (1) item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.

5. Written Text: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.

6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.
   a. Do not use original Record Documents as part of operation and maintenance manuals.

7. Warranties and/or Bonds: Provide a copy of each warranty and/or bond in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

1.6 MATERIAL AND FINISHES MAINTENANCE MANUAL

A. Submit two (2) hard copies and five (5) digital copies (USB) of each manual, in final form, on material and finishes to the Construction Administrator for distribution. Provide one (1) section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.
   1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.

B. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.
   1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
      a. Manufacturer's catalog number.
      b. Size.
      c. Material composition.
      d. Color.
      e. Texture.
      f. Reordering information for specially manufactured products.

   2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information on cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.
C. Moisture Protection and Products Exposed to the Weather: Provide complete manufacturer’s data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.

1. Manufacturer’s Data: Provide manufacturer’s data giving detailed information, including the following, as applicable:
   a. Applicable standards.
   b. Chemical composition.
   c. Installation details.
   d. Inspection procedures.
   e. Maintenance information.
   f. Repair procedures.

D. The contractor shall provide QR codes for the O&M equipment when possible.

1.7 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Submit two (2) hard copies and five (5) digital copies (USB) of each manual, in final form, on equipment and systems to the Construction Administrator for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.

1. Refer to individual Specification Sections for additional requirements on operation and maintenance of the various pieces of equipment and operating systems.

B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:
   a. Equipment or system function.
   b. Operating characteristics.
   c. Limiting conditions.
   d. Performance curves.
   e. Engineering data and tests.
   f. Complete nomenclature and number of replacement parts.

2. Manufacturer’s Information: For each manufacturer of a component part or piece of equipment, provide the following:
   a. Printed operation and maintenance instructions.
   b. Assembly drawings and diagrams required for maintenance.
   c. List of items recommended to be stocked as spare parts.

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:

4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
   a. Startup procedures.
   b. Equipment or system break-in.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Instructions on stopping.
   f. Shutdown and emergency instructions.
   g. Summer and winter operating instructions.
h. Required sequences for electric or electronic systems.
   i. Special operating instructions.

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

7. Identification Drawings: Provide each Contractor's Identification Drawings.
   a. Provide as installed, color-coded, piping diagrams, where required for identification.

8. Valve Tags: Provide charts of valve-tag numbers, with the location and function of each valve.

9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panel boards, including the following:
   a. Controls.
   b. Communication.

Electronic Media:

1. For equipment which requires maintenance by operational personnel, provide a professionally developed DVD for the use of maintenance training for the facility. Each DVD will be accompanied by a written index which can be utilized to find any specific item of information by time or place on the DVD.

2. The Contractor is responsible for this production. This DVD will be provided to the Construction Administrator at the same time as the delivery of the other maintenance material.

3. The DVD must be able to be edited for future changes to the equipment and modifications as they occur.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

***
PART 1 – GENERAL

1.1 GENERAL PROVISION
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section 01 33 00 "Submittal Procedures" specifies procedures for submitting warranties.

2. Division 01 Section 01 77 00 "Closeout Procedures" specifies contract closeout procedures.

3. Division 01 Section 01 78 23 "Operation and Maintenance Data" specifies required operation and maintenance data.

4. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

5. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 CORRECTING OR REPLACEMENT OF WARRANTIED CONSTRUCTION
A. Related Damages and Losses: When correcting failed or damaged warrantied construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warrantied construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law.
Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

F. The Contractor shall guarantee all materials and workmanship for a period of 12 months from the date of Substantial Completion of the Work. In addition, where applicable, the Contractor shall furnish the warranties as stipulated in each section of the Specifications, whichever is greater. Submit four (4) copies of each to the Construction Administrator in the supplier's standard form or in the form given below if there is no standard form available.

G. Submit certification that finish materials are fire rated as specified.

H. Form of Guarantees and Warranties:

Town of Granby, Connecticut (Granby Memorial High School) – Project No.               

I (We) hereby guarantee and warranty

the ________________ work on the referenced project for a period of ____________ years

from _____________, 20__ against failures of workmanship and materials in accordance

with the requirements of Section ____, Page ____, Paragraph ____, of the Specifications.

Signed

____________________________________

General Contractor   (or authorized agent)

I. Bonds shall be by approved Surety Companies, made out to the Commissioner, Department of Public Works, on company's standard form.

J. Guarantees, warranties or bonds supplied by Subcontractors, Suppliers or Manufacturers shall reference the project name, number, and location and be certified by the Contractor to be for the product and installation on the project and must be countersigned by the Contractor.

1.4 SUBMITTALS

A. Submit written warranties prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
B. Forms for special warranties are included in this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Construction Administrator, for approval prior to final execution.

1. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 81/2-by-11-inch paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not applicable)
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
Section includes selective demolition and disposal of all removed materials from the work area and site. Provide all work as required to prepare building for specified new construction of this contract. Salvage and store indicated building items for reuse. Related Sections include the following:
1. Division 02 Sections for "Selective Demolition".
2. Division 22 Sections for "Plumbing".
3. Division 23 Sections for "HVAC".
4. Division 26 Sections for "Electrical".
5. Division 31 Section for "Earthwork"

1.3 JOB CONDITIONS
Security: The General Contractor shall assume responsibility for control and security of the construction areas within the property lines.
Codes and Permits: Comply with all rules, regulations, laws and ordinances of the Town of Madison, the State of Connecticut and all other authorities having jurisdiction. Procure and pay for all permits and licenses required for specified work.
Protection: Provide all measures required by federal, municipal and state ordinances, laws and regulations for the protection of surrounding property and public. Provide all necessary bracing and shoring in connection with demolition work, and be solely and entirely responsible for the complete safety and support of such construction. Protect all walks, roads, streets, curbs, pavements, trees and planting, on or off the site. Repair and replace or otherwise make good all damages as directed by the Architect.

1.4 HAZARDOUS MATERIALS
If hazardous materials are discovered, cease work in the affected area only and continue work in other areas. Notify Architect and Owner of discovery. Do not proceed with work in affected areas until instructions are received.

1.7 QUALITY ASSURANCE
Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
Standards: Comply with ANSI A10.6 and NFPA 241.

1.8 PROJECT CONDITIONS
Work area will be vacated prior to the commencement of construction. Owner assumes no responsibility for demolition operations. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practical.
PART 2 - PRODUCTS

2.1 Products
As selected by Contractor and approved by Architect.

PART 3 - EXECUTION

3.1 Inspection
The Contractor must visit the site, examine conditions and become familiar with the extent and type of demolition and removal required.

1. Verify existing conditions of structure and all items scheduled and/or necessary for demolition or removal. Do not proceed with any work that will result with unsafe conditions causing a continuing or permanent hazard.

2. Ascertained that all work scheduled for demolition can be safely accomplished in a proper time period.

3. The Contractor shall photograph existing conditions of structure's surfaces, which could be misconstrued as damage resulting from selective demolition work, and file with Owner's representative prior to starting work.

4. The Demolition Plans are prepared to assist the Contractor to determine generally this work to be performed. Selective demolition of building elements to accommodate structural, Plumbing, HVAC (Divisions 22 and 23) and electrical components (Division 26) are not shown on the drawings but are the responsibility of the Contractor. Necessary or required demolition for all other Divisions not indicated on these plans is the responsibility of the Contractor.

5. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION
Control: Take all reasonable precautions to limit extent of dust, dirt and noise.

1. Wet down drywall, concrete, masonry, and similar dust-producing materials before and during placing in trucks or in open storage containers.

2. Use only trucks equipped with approved tarpaulins for transporting of dust-producing materials and materials that could be dislodged by wind.

3.3 METAL ROOF DECK COORDINATION.

1. Coordinate removal of metal roof decking with Section 07 53 23 EPDM Roofing and Division 23 Mechanical to ensure that work is performed expeditiously by all trades to reduce the exposure for leaks.

3.4 PROCEDURES

Cutting: Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care in cutting existing surfaces containing concealed piping, which is to remain and bear full responsibility for repairing or replacement of all such work which is accidentally damaged.

Surfaces: Except where special surface preparation is specified under other Sections, leave existing surfaces to remain in a condition suitable to receive new materials and finishes.

Items to Remain: Restore to original condition all existing items and finishes to remain that are damaged as a result of work under this Section.
Granby Memorial High School Renovations
Granby, CT

Flooring: Where scheduled, remove existing flooring. Leaving existing surface suitable to receive new flooring as specified.

3.5 UTILITIES
Fire Protection, Plumbing, HVAC and Electrical Services: Prior to commencing demolition work, take all precautionary measures to assure that fire protection, plumbing, HVAC and electrical services have been disconnected or otherwise made inactive. Plumbing, HVAC and Electrical subcontractors or journeymen licensed in each trade shall disconnect and cap, where necessary, existing fire protection sprinkler system, plumbing, HVAC and electrical utilities within the building.

3.6 CLEARING
Clear and grub areas required for execution of the work. Legally dispose of all waste material off site.

3.7 DISPOSAL
General: Except for items specifically designated to be re-used or turned over to Owner, all existing removed materials and items shall become the property of the Contractor and be completely removed from site and legally disposed of at Contractor’s expense.
Transport: Thoroughly wet down materials during demolition and removal to prevent nuisance of dirt and dust. Equip trucks used in hauling debris with tarpaulins to cover the weeds. Do not load excessively or spill debris on streets. Verify and adhere to trucking disposal routes with Town.
Combustible Materials: Do not accumulate on the site but haul away daily as directed. No debris shall be burned at job site. Remove refuse and debris resulting from work from the site at daily intervals. Make all required arrangements for legal disposal of such material.
Rubbish: Remove all rubbish and debris resulting from demolition work daily. Legally dispose at offsite location. Do not throw or drop materials from openings in exterior walls.
Clean-up: At completion of demolition work, remove from site all debris, tools, scaffolds, apparatus and appliances used in connection with work. Leave premises in clean condition ready for new construction.

3.8 TEMPORARY SUPPORT
Provide temporary shoring and support to the existing building during demolition and construction as required. Review the schedule of demolition with Architect and Owner prior to execution of work. Notify the Architect of any alterations or changes due to unforeseen circumstances.

3.9 GENERAL
Barricade open excavations occurring as part of this work. Furnish, install and maintain required construction aids such as ladders, platforms, railings, hoists, cranes, etc. Remove on completion of work. Consult Owner or Utility Company immediately, should unknown or uncharted piping or other utilities be encountered.

PART 4 - DRAWINGS
The Drawings indicate the general extent of demolition and removal of work. Necessary or required demolition not indicated on these drawings is the Contractor’s responsibility. Include removal of all existing materials which would otherwise interfere with the proper installation or function of new work, whether or not such existing materials or conditions have been indicated. Do all demolition and removal work indicated under this Section except where specifically indicated to be done under other Sections. Wherever a portion of the existing building is indicated to be demolished or removed, completely remove all components contained in such portion except those specifically indicated to
remain. Do additional items as are necessary to accomplish the intended renovation and addition work in a safe, intelligent and practical manner.

Schedule of items to be removed, salvaged and re-used:

END OF SECTION 02 41 19
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. The General Provisions of the Contract, including the General and Supplementary Conditions, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK
   A. Furnish all labor, supervision, materials, tools and equipment necessary for or reasonably incidental to completion of all cast-in-place concrete as shown on the Contract Drawings and/or specified herein.
   B. Work shall include all work to infill areas where existing slabs are scheduled to be removed due to trenching through slabs for utilities, removal of slabs for new refrigerator/freezer construction, and where kitchen equipment requires modifications to slab elevations for equipment installation.
   C. Pads and miscellaneous concrete as required for locker installation.
   D. Place all anchors, inserts, dovetail slots, hangers, sleeves, and etc. which must be encased in concrete for other Divisions.

1.3 QUALITY ASSURANCE
   A. Standards
      1. Concrete work shall conform to all requirements of ACI-301 “Specifications for Structural Concrete” latest edition.
   B. Testing Agency
      1. The Owner will engage and pay for an independent commercial testing laboratory to test concrete used on this project.
      2. Testing required under Section 2.2, Proportions, shall be by an independent commercial laboratory and at the Contractor's expense.
   C. Quality Control
      1. Compression Tests
         a. Tests shall be made in conformance with ASTM C39. Each test shall consist of four (4) cylinders made and tested by the laboratory during the progress of the project, testing as follows:
            i. One (1) - after curing seven (7) days in the field.
            ii. Three (3) - after curing twenty-eight (28) days in the laboratory.
         b. At least one (1) test shall be made every one hundred (100 cy) cubic yards of concrete or fraction thereof, placed in any one concreting operation on any given day.
         c. Concrete for each set of cylinders shall be from any one (1) sample, representative of the entire batch.
         d. Specimens shall be made, cured and tested in accordance with ASTM C31.
e. When concrete is pumped, test cylinders shall be made from concrete taken at the
discharge end of the pumping train.

2. Additional tests as follows shall be made from the concrete taken to mold the cylinders.
   a. Slump test: in accordance with ASM C143.
   b. Air-entrainment test: in accordance with ASTM C173 or ASTM C231.

3. The Contractor shall notify the testing laboratory twenty-four (24) hours before concrete
placement and shall cooperate in making of cylinders by the testing laboratory.

1.5 SUBMITTALS

A. Test Reports
   1. Report of tests shall be submitted to the Engineer and shall include: name of job, date and
      location of placement, class of concrete, mix data, and slump, air content, compressive
      strength, age and condition of test cylinders, weight of each cylinder tested for 7 day break,
      type of fracture, and method of curing.

   2. One (1) copy of all test reports shall be promptly forwarded by the testing laboratory to the
      Engineer, plus one (1) copy each to the Architect, Contractor and Concrete Supplier.

B. Test Results
   1. The average of the tests for any portion of the structure shall equal or exceed the specified
      twenty-eight (28) day compressive strength (fc).
   2. No single strength test shall have a value less than 90% of the specified compressive strength
      (fc).
   3. Where the concrete does not comply with these requirements, the Engineer may require other
      tests, such as cored cylinders (in conformance with ASTM C42) or load tests, all at the
      Contractor's expense. Should the concrete fail to pass such tests, it shall be removed and
      replaced at no additional cost to the Owner. In addition, the Contractor may be required to
      remove and replace sound portions of structure as necessary to insure safety, appearance,
      and durability of the structure. Additional load tests strengthening or removal and
      replacement of parts of structure and any costs associated with delay of projects shall be at
      Contractor's expense.

C. Concrete Proportions
   1. See Section 2.2A thru 2.2J for additional requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: domestic portland cement conforming to ASTM C150, Type I or Type II.

B. Fine aggregate: natural sand conforming to ASTM C33.

C. Coarse aggregate: crushed stone or crushed washed gravel conforming to ASTM C33.

D. Water: clean, potable.

E. Admixtures: Each admixture shall be approved by the Engineer. No admixtures containing
   calcium chloride or other water soluble chlorides will be allowed. Each manufacturer shall submit
   a written notarized statement to the Engineer of the chloride content of each admixture.
   Formulate admixtures to avoid an increase in water-cement ratio or loss of strength.
2. Retarder - Densifier: ASTM C-494, Type D.
3. Accelerator: ASTM C-494 Type C.


H. Polyethylene film: white opaque, reinforced six (6) mils thick.

I. Under-slab Vapor Retarder:
   1. Non-woven plastic geo-membrane sheet product meeting or exceeding the requirements of an ASTM E-1745 vapor retarder.
   2. Waterproof tape for connecting sheets.
   3. Performance Requirements:
      a. Permeance of less than 0.01 Perms [grains/(ft² – hr – inHg)] as tested in accordance with ASTM E 1745 Section 7.
      b. Other performance criteria:
         i. Strength: Meet ASTM E 1745 Class A requirements.
         ii. Tensile Strength: 45 pound-feet / in per ASTM D-882 or E-154 3). iii. Puncture Resistance: 2200 grams per ASTM D-1709
         iv. Thickness: 15 mils minimum

3. Manufacturer:
   b. Other acceptable products:

J. Curing paper shall be the approved equal of Sisalkraft Paper "Orange Label" that conforms with ASTM C171, Type I.

K. Premolded joint filler shall be a preformed bituminous expansion type that conforms to ASTM D-994. Joint material thickness shall be one-half (1/2") inch thick, except as otherwise indicated on the drawings.

L. Formwork
   a. Wood edging and stakes for edges of exterior concrete work and where required for interior slab depressions.
   b. Release agent for wood forms.
   c. Preformed treated cardboard-based round tube forms equal to Sonotube or equivalent.

2.2 PROPORTIONS
A. Concrete mix proportions shall be selected to produce an average compressive strength exceeding the required twenty-eight (28) day compressive strength (fc) in accordance with ACI 318 Chapter 5.3, proportioning on basis of field experience or trial mixtures, or both. The Contractor shall submit to the Engineer the concrete strength to which the materials were proportioned, and copies of any records that the concrete supplier may have showing standard deviations in previous mixes.

B. Mix proportions shall be as outlined in ACI 301 Section 4 by the testing laboratory.

C. Where a concrete production facility has a record, based on at least thirty (30) consecutive strength tests that represent similar materials and conditions to those expected, required average compressive strength used as the basis for selecting concrete proportions shall exceed required fc at designated test age by at least:
   - 400 psi if standard deviation is less than 300 psi
   - 550 psi if standard deviation is 300 to 400 psi
   - 700 psi if standard deviation is 400 to 500 psi
   - 900 psi if standard deviation is 500 to 600 psi

   1. If standard deviation exceeds 600 psi, concrete proportions shall be selected to produce an average strength at least 1200 psi greater than required fc.

D. Strength test data for determining standard deviation shall be considered to comply with Section 2.2C, if data represents either a group of at least thirty (30) consecutive tests or a statistical average for two (2) groups totaling thirty (30) or more tests.

E. Strength tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1000 psi of that specified for the proposed work.

F. Changes in materials and proportions within the population of background tests used to establish standard deviation shall not have been more closely restricted than for the proposed work.

G. After sufficient experience and test data become available from the job, using ACI 211 methods of evaluation, the standard deviation may be reduced when the probable frequency of tests more than 500 psi below required compressive strength will not exceed one in one hundred (1 in 100), and that probable frequency of an average of three (3) consecutive tests below required compressive strength will not exceed one in one hundred (1 in 100).

H. If it is intended to place any concrete by pumping, a corresponding mix shall be designed for such placement and so designated.

I. No concrete shall be placed until tests of design mixes show a twenty-eight (28) day average compressive strength at least equal to the specified design compressive strength or until the concrete design mix proportions have been accepted by the Engineer.

J. Contractor shall submit the following data:
   1. Fine aggregate - organic content, sieve analysis, fineness modulus and specific gravity.
   2. Coarse aggregate - sieve analysis and average weight loss in accordance with ASTM C-33.
   3. Mix design, including cement brand, proportions of aggregate by weight, slump, water-cement ratio, percentage of air.
   4. Thirty (30) twenty-eight (28) day compressive test results on proposed mix that comply with Section 2.2C.
   5. Admixture-types, brand and quantity.

2.3 SPECIFIC REQUIREMENTS
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A. Concrete shall meet the values shown in the following Table except as noted in paragraph D below:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slump (inches)</td>
<td>2 1/2 - 4</td>
</tr>
<tr>
<td>Max. size coarse aggregate (inches)</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Max. size coarse aggregate for suspended slabs and pumped concrete (inches)</td>
<td>3/4</td>
</tr>
<tr>
<td>Max. size coarse aggregate for minimum 5 inch thick slab on grade (inches)</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Min. cement factor (sacks per cy)</td>
<td>5 1/2</td>
</tr>
</tbody>
</table>

1. Water content shall include surface water in aggregates.

B. Concrete for Interior Slabs shall also conform to the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. compressive strength @ 28 days (psi)</td>
<td>3,000</td>
</tr>
<tr>
<td>Maximum water cement ratio</td>
<td>0.48</td>
</tr>
<tr>
<td>Min. cement factor (sacks per C.Y.)</td>
<td>5 1/2</td>
</tr>
</tbody>
</table>

1. Mix shall include a mid-range water reducer such as Polyheed 997 as manufactured by Master Builders, Inc. or equivalent.
2. Mix shall be proportioned to provide a maximum 5” slump at point of discharge.
3. Interior concrete slabs-on-grade shall not be air entrained.

C. Concrete for exterior flatwork shall be 5,000 psi at twenty-eight (28) days and meet the values shown in the following Table:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. compressive strength @ 28 days (psi)</td>
<td>5,000</td>
</tr>
<tr>
<td>Slump (inches)</td>
<td>2 1/2 - 4</td>
</tr>
<tr>
<td>Max. size coarse aggregate (inches)</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Max. size coarse aggregate for suspended slabs and pumped concrete (inches)</td>
<td>1</td>
</tr>
<tr>
<td>Max. size coarse aggregate for minimum 5 inch thick slab on grade (inches)</td>
<td>1 1/2</td>
</tr>
<tr>
<td>Min. cement factor (sacks per cy)</td>
<td>6 1/2</td>
</tr>
</tbody>
</table>

1. Water content shall include surface water in aggregates.

D. All concrete exposed to the weather, including site work, shall be air-entrained as follows:

<table>
<thead>
<tr>
<th>Aggregate Size</th>
<th>Air Content % by Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2 inch</td>
<td>4 - 7</td>
</tr>
<tr>
<td>1 inch</td>
<td>4.5 - 7.5</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>4.5 - 7.5</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>5.5 - 8.5</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>6 - 9</td>
</tr>
</tbody>
</table>

E. Variations of proportions may be permitted to produce more workable materials on approval by the Engineer.

PART 3 - EXECUTION

3.1 PRIOR TO PLACING CONCRETE

A. Soil bottoms for footings and slabs shall be accepted by the Engineer before placing concrete. The subgrade shall be free of frost before concrete placing begins.

B. All debris, sawdust, ice, etc., is to be cleaned from place of deposit before concrete is placed.
C. All water is to be removed from place of deposit before concrete is placed. Provide drainage or pumping as required to maintain dry excavation until concrete has taken initial set.

D. All conduits and piping are to be dug into subgrade sufficiently so as to provide uniform slab thickness.

E. Prior to placing any concrete, the Contractor shall notify the Engineer twenty-four (24) hours in advance so that formwork and reinforcing may be inspected. Do not place concrete until inspection has been made or waived.

F. All dowels, anchor bolts, sleeves, inserts and other embedded items shall be set with the aid of templates and shall be securely positioned in place prior to the placement of concrete.

G. Install under slab vapor retarder and waterproof tape to existing membranes and all new interior slab work.

H. Securely install forms; to prevent collapse during concrete placement; true to line; vertical and plumb. Treat forms to be removed with release agent.

3.2 MIXING

A. Concrete shall be ready-mixed in conformance with the requirements of ASTM C94 for measurement of materials, batching, mixing and delivery, and shall be discharged within one and one-half (1 1/2) hours after water is first added to the mix, except that in unusually hot weather, this maximum time may be reduced.

B. Mixing and conveying equipment shall be thoroughly clean and free from hardened concrete and foreign materials before concrete operation is started.

C. All materials including water shall be added to ready-mixed concrete at the batching plant. Water shall not be added to the mix on the project site. Mixing shall be continued for at least one and one-half (1 1/2) minutes prior to its use.

D. Mixer shall produce thoroughly mixed, uniform mass, and discharge mixture without segregation. Entire batch shall be discharged before mixer is recharged.

E. Partially hardened concrete shall not be retempered or used.

F. Delivery Tickets
   1. One (1) copy of all concrete delivery tickets shall be furnished to the Engineer on request. Contractor shall note on tickets location of placement. Delivery tickets shall provide the following information:
      a. Date and truck number
      b. Name of ready-mix batch plant
      c. Contractor and job location
      d. Cement brand, type mix number and weight in pounds
      e. Fine aggregate weight in pounds
      f. Maximum size of aggregate
      g. Coarse aggregate weight in pounds
      h. Water in gallons
      i. Admixture, name and amount in concrete, if any
      j. Amount of concrete in cubic yards
      k. Time mix left plant

3.3 DEPOSITING CONCRETE
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A. Depositing of all concrete shall be in accordance with ACI 304.

B. Concreting shall conform to the requirements of ACI 305 or ACI 306 in hot or cold weather as required. See Section 3.8.

C. All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

D. Unless adequate protection is provided, and approved by the Engineer, concrete shall not be placed during rain, sleet, or snow.

E. Concrete shall be conveyed from the mixer to the place of final deposit in a practically continuous flow by methods which will prevent the separation or loss of the ingredients. It shall be placed in the forms or on grade as nearly as practicable to its final position and shall be thoroughly vibrated around all reinforcing bars and mesh to assure complete absence of voids. Under no circumstances shall partially hardened concrete be placed in the work. Concrete shall be prohibited from free-falling in excess of four (4) feet.

F. Concrete may be pumped. Use of aluminum alloys in the pumping train is prohibited.

G. Concrete shall be thoroughly compacted and worked into the forms and around the reinforcing by means of suitable mechanical vibrators. Sufficient vibrators shall be on hand to allow for breakdowns. Vibrators shall be run deep into the concrete and shall remain in one position until the concrete is thoroughly compacted, but not long enough to cause segregation of the aggregates.

H. Vertical lifts shall not exceed eighteen (18") inches. Vibrate through successive lifts to avoid pour lines. Vibrate first lift thoroughly until top of lift glistens to avoid stone pockets, honeycomb, and segregation.

I. Concrete shall be deposited continuously, and in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within section. If section cannot be placed continuously between planned construction joints, as specified, field joint and additional reinforcement shall be introduced so as to preserve structural continuity. Engineer shall be notified in any such case.

J. Unless otherwise permitted, the work shall be so executed that a section begun on any day shall be completed in daylight on the same day.

K. Cold joints, particularly in exposed concrete, including "honeycomb", are unacceptable. If they occur in concrete surfaces exposed to view, Engineer may require that entire section in which blemish occurs be removed and replaced with new materials at Contractor's expense.

3.4 CONSTRUCTION AND CONTROL JOINTS

A. Slab on Grade, and Structural Slab
   1. Interior slab construction joints shall align with those existing.
   2. The surface of the concrete at all joints shall be hard and thoroughly cleaned prior to placing adjoining concrete.
   3. The cured or partially cured concrete of construction joints, except at locations noted below, shall be dampened (but not saturated) immediately prior to the placing of fresh concrete.
   4. The face of hardened concrete joints in exposed work and joints in the middle of beams, girders and slabs shall be dampened (but not saturated) and then thoroughly covered with a
coat of neat cement grout of similar proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least one-quarter (1/4") inch thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained its initial set.

5. Construction joints shall be constructed with reinforcing continuous through joint unless otherwise shown. All key bulkhead joints shall be constructed with a key depth of one-third (1/3) the total thickness unless otherwise shown.

6. Sawcut control joints in slabs shall be saw cut within twenty-four (24) hours of concrete placement. Control joint shall be sawed to depth of one-quarter (1/4) of the slab thickness.

7. Unless otherwise shown on the Drawings, slabs on grade shall be broken down into sections with control and/or construction joints that do not exceed six hundred fifty (650 sf) square feet area and whose dimensions do not exceed a one and one half to one (1 1/2 to 1) ratio.

3.5 FINISHED CONCRETE SURFACES

A. Slabs Finishing

1. All interior concrete slabs shall be finished by screeding floating, floated finish, and steel troweled to a smooth even surface in accordance with ACI 301, Section 5.3.4, unless otherwise noted.

2. All exterior slabs and interior slab scheduled for toppings shall be finished by screed floating, floated finish and broom finish in accordance with ACI 301, Section 5.3.4.

3. Any slab surface finish not specified shall be finished in accordance with ACI 301, Section 5.3.4.2.j.

4. No dry cement or other materials shall be applied to surface of any concrete slab to absorb moisture prior to finishing.

5. Provide a positive pitch to all floor drains as shown. Pitch exterior slabs away from the building.

6. Provide one-eighth (1/8") inch radius tooled edging at all exposed slabs and/or sidewalk edges.

7. Provide proper depression in concrete to accept specified finish floor materials.

3.7 CURING

A. All concrete shall be kept constantly moist and protected against any drying action for not less than seven (7) days after placing of the concrete, and shall be accomplished in the following manner:

1. All slabs, either slab on grade or suspended slabs, shall be cured using curing paper.

8. Where concrete is cured by curing paper, cover surface immediately after finishing. Joints shall be lapped five (5") inches, and squeegee curing paper to remove wrinkles. Repair all rips and tears until end of curing period.

9. The use of curing compounds on exterior slab on grade construction (sidewalks) is not permitted.

3.8 CONCRETING PRECAUTION FOR WEATHER EXTREME

A. Cold weather: Precautions shall be taken when the temperature is at or below 40 degrees F, or at 45 degrees F and falling, in accordance with "Guide to Cold Weather Concreting", ACI 306.

1. Set up a proper enclosure and heat to 50 degrees F for at least four (4) hours before starting any pour.

2. Use a water-reducing admixture with an accelerated set, but do not use or rely upon any materials as an "antifreeze".
3. Use vented heaters with blowers so placed that they do not produce localized hot spots which may dry out the concrete.

4. Maintain the temperature of the concrete at not less than 50 degrees F for seventy-two (72) hours and at above freezing for an additional seven (7) days. The temperature shall then be allowed to drop gradually to the exterior air temperature before the enclosure is removed at the rate of not more than 5 degrees F per hour nor 50 degrees F in any twenty-four (24) hour period before discontinuing.

5. All frozen concrete shall be removed from the job and replaced.

B. Hot weather: Precautions shall be taken when the temperature is at or above 75 degrees F, or at 70 degrees F and rising, in accordance with "Guide to Hot Weather Concreting", ACI 305. No concrete shall be placed when the air temperature is above 90 degrees F, unless the air is still and relative humidity is above eighty (80%) percent.

1. Set up proper windbreakers for concrete surfaces wherever the relative humidity is less than 70% for slight air motion or 80% for light breezes.

2. Provide shade for placements otherwise exposed to the sun.

3. Concrete is to be at a temperature of 80 degrees F, or less when placed. If necessary, the batching plant shall cool the aggregate by spraying or by using chilled water or ice. All such water shall be accounted for as part of the mixing water.

4. Use an admixture with a retarded set.

5. All forms shall be thoroughly wetted at least daily, and more often when the relative humidity is low.

6. For slabs, maintain the required materials for curing at hand so they may be placed immediately upon steel troweling. When the concrete temperature of any slab goes above 100 degrees F, place a layer of sand on it and keep it continuously wet until the temperature is below 90 degrees F.
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SECTION 05 40 00
COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General Requirements, apply to the work of this Section.
B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY
A. Design, engineer, furnish and install cold formed metal framing (also referred to as “LGMF” on Drawings) for the following applications:
   1. Load bearing formed steel stud floor framing for risers.
   2. Modifications to existing exterior walls to accommodate new openings.
   3. Include all connections, bracing, bridging, support, and accessories.

1.3 RELATED SECTIONS
A. Section 04 20 00 – “UNIT MASONRY ASSEMBLIES”: Veneer masonry supported by exterior wall metal framing.
B. Section 06 10 00 – “ROUGH CARPENTRY”: In-wall wood blocking.
C. Section 07 21 00 – “BUILDING INSULATION”: Batt and blanket insulation within framing members.
D. Section 09 22 00 – “METAL SUPPORT ASSEMBLIES”: Light weight, non-load bearing metal stud framing.
E. Section 09 29 00 – “GYPSUM BOARD”: Interior wall finish.

1.4 REFERENCES
A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – “REFERENCE STANDARDS & DEFINITIONS”.
   1. ANSI - Cold-Formed Steel Design Manual.
   2. ASTM A 123 - Zinc Coatings on Iron and Steel Products.
   3. ASTM A 446 - Steel Sheet, Zinc-Coated by Hot Dip Process, Physical Quality.
   4. ASTM A 570 - Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
   5. ASTM A 611 - Steel, Cold-Rolled Sheet, Carbon, Structural.
   6. ASTM A 645 - Steel Sheet, Pressure Vessel Plates, Five Percent Nickel Alloy Steel, Specially Heat Treated.
   7. ASTM C 985 - Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Base.
   8. AWCI: Specifications Guide for Cold Formed Steel Structural Members.
   10. AWS D 1.3 - Light Steel Welding Code.
11. ML/SFA: Guidelines for the Use of Metal Framing.


1.5 DESIGN REQUIREMENTS

A. Engineering: Provide the services of a Professional Engineer, registered in the State of Connecticut to design engineer, and certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by Connecticut State Building Code.

B. Structural performance: Design, engineer and provide a complete metal framing and support system having deflection limits as specified herein under the full inward and outward lateral load prescribed by applicable codes for this project location. Deflection and structural calculations shall not include any structural benefit from the veneer or curtain wall system; metal framing alone shall carry the loads. Where a member supports more than one finish, the most restrictive deflection shall govern.

1. Deflection limit for masonry veneer: L/720 where L is the length of the steel member.

2. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

3. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

C. Welding: Employ experienced welders who are certified in compliance with AWS Standard Qualification Procedures.

1.6 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – “SUBMITTAL PROCEDURES”:

1. Literature: Manufacturer’s product data sheets, specifications, performance data, physical properties and limitations on standard framing members and other products furnished hereunder.

2. Provide calculations for loading and stresses of walls under the Professional Structural Engineer’s seal. Show how design load requirements and other performance requirements have been satisfied.

3. Manufacturer’s installation instructions: Indicate special procedures, and conditions requiring special attention.

4. Prior to prefabrication of framing, submit fabrication and erection drawings for approval. All calculations and details are to be submitted for all members and connections.

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:

   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
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b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturers certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.


1.7 QUALITY ASSURANCE

A. Calculate structural properties of framing members in accordance with AWCI, MF/SLA and AWS D1.3 requirements.

B. The registered engineer as referenced in Article 1.4, is to make periodic visits to the site to inspect and test as necessary the light gage structural framing assemblies. Prior to work commencing, the engineer shall submit a program of testing and inspection to the Architect and Structural Engineer of Record (SER) for review. After completion of the work based on these inspections, an affidavit stamped with the seal of the engineer is to be issued. The affidavit shall state that the work has been installed in accordance with his/her design.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

B. Installer: Company with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Coordinate with the placement of components within the stud framing system, specified in Section 07 21 00 – “BUILDING INSULATION”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Dietrich Industries, Inc., Pittsburgh PA.
2. Gold Bond Building Products/National Gypsum Company, Charlotte NC.
3. MarinoWare, a division of Ware Industries, Plainfield, NJ.

2.2 MATERIALS
A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus 0=one-half of pre-consumer recycled content is not less than 25 percent.

B. Sheet Steel: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 (Z275).

2.3 NON-LOAD-BEARING WALL FRAMING & LOAD-BEARING FLOOR FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (16 gauge).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated.
   Unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Available Manufacturer's: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the Following:
      b. MarinoWARE, a division of Ware Industries.
      c. The Steel Network, Inc.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from sheet steel, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
1. Acceptable Manufacturer’s: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer’s standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 or ASTM A 780.
   1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1007, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, non-leaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer’s standard widths to match width of bottom track or rim track members.

2.7 FACTORY FINISHING

A. All studs and accessories shall be primed with rust inhibitive paint meeting the performance requirements of TT-P-636C or shall be formed from steel having a G-90 galvanizing coating.

B. Tracks and headers: Galvanize to G 90 coating class.

C. Bracing, bridging, furring, plates, gussets and clips: ASTM A 123, hot dip galvanized to 1.25 ounce-per-square-foot.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect previous work, related work, and conditions under which this work is to be performed and notify Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work.

B. Beginning of installation means acceptance of substrates, previous work and conditions.

3.2 ERECTION - GENERAL

A. Accurately align and attach runners in strict compliance with manufacturer’s recommendations and approved shop drawings. Anchor studs to bottom runners by welding on both faces or by mechanically fastening with one low profile pan head screw in each stud flange one each side of runner. Allow for main structure deflection at top runner of
partitions to avoid transferring load stud system. Provide 1/2 to 3/4 inch clearance between top of studs and top runner at wall conditions.

1. Frame wall openings with additional framing members at perimeter of openings as needed.
   2. Align holes in framing members to facilitate electrical conduit and piping work.
   3. Provide all needed connections and accessories provide a complete structural system.
   4. Provide all needed members for proper fastening interior gypsum wallboard.

B. Bracing: Provide continuous 1-1/2 inch cold-rolled channel horizontal bracing within 10 to 12 inches of tops of stud. Connect bracing to each stud with welded or mechanical fastened clip angles. Provide additional bridging and bracing as recommended by manufacturer, as necessary, and as indicated on approved shop drawings. Provide kickback bracing perpendicular to plane of framing system and securely anchored to building structure needed to create a complete structural system meeting specified performance requirements.

C. Touch-up damaged metal coatings, including every screw penetration from sheathing attachment, with galvanize repair paint.

3.3 ERECTION OF STUDDING

A. Install components in accordance with manufacturer’s instructions.

B. Align floor and ceiling tracks; locate to wall partition layout. Secure in place with fasteners at maximum 24 inches on center.

C. Install floor framing to accommodate changes in elevation of proposed flooring and for blocking required for attachment of plywood decking and railing systems.

D. Place studs at not more than 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.

E. Construct corners using minimum three studs. Double stud wall openings, door and window jambs.

F. Erect load bearing studs one piece full length. Splicing of studs is not permitted.

G. Erect load bearing studs, brace, and reinforce to develop full strength, to achieve design requirements.

H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

I. Install intermediate studs above and below openings to align with wall stud spacing.

J. Provide deflection allowance in stud track at walls, directly below horizontal building framing at nonload bearing framing.

K. Attach cross studs, furring channels to studs for attachment of fixtures anchored to walls.

L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

M. Touch-up field welds and damaged galvanized and primed surfaces with primer.

N. Complete framing ready to receive exterior gypsum sheathing and metal wall panel system.

3.4 ERECTION (WIND LOAD ONLY)

A. Tracks shall be securely anchored to the supporting structure as shown on the Drawings.
B. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element or they shall be butt-welded spliced together.

C. Studs shall be plumbed, aligned and securely attached to the flanges or webs of both upper and lower tracks.

3.5 ERECTION (AXIAL LOAD-BEARING)

A. Tracks shall be securely anchored to the supporting structure as shown on the plans, and as designed and detailed on approved shop drawings.

B. Complete uniform and level bearing support shall be provided for the bottom track.

C. At track butt joints, abutting pieces of track shall be securely anchored to a common structural element or they shall be butt-welded or spliced together.

D. Studs shall be plumbed, aligned and securely attached to the flanges or webs of both upper and lower tracks.

E. Framed wall openings shall include headers and supporting studs as shown on the plans, and as designed and detailed on approved shop drawings.

F. Jack studs shall be installed below window sills, above window and door heads, at free standing stair rails and elsewhere to furnish support and shall be securely attached to supporting members.

G. Temporary bracing shall be provided until erection is completed.

H. Wall stud bridging shall be installed in a manner to provide resistance to both minor axis bending and rotation. Bridging rows shall be equally spaced not to exceed 4 feet on-center.

I. Provide stud walls at locations indicated on plans as “sheer walls” for frame stability and lateral load resistance. Such stud walls shall be braced as indicated on plans and specifications.

J. Splices in axially loaded studs shall not be permitted.

K. Provide insulation equal to that specified elsewhere in all doubled jamb studs and double header member which will not be accessible to the insulation contractor.

3.6 TOLERANCES

A. The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Documents and shall not be added to allowable tolerances indicated for other work.

1. Allowable variation from true plumb. Level. & Line: 1/8 inch in 20 feet.

2. Allowable variation from true wall thickness: 1/8 inch in 20 feet.

3. Allowable variation from true plane of adjacent surfaces: 1/8 inch in 10 feet.
PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish and install:
   1. Steel Loose Lintels.
   2. Steel framing and supports for new floor and roof openings.

B. Furnish the following items for installation under related sections:
   1. Lintels, anchor bolts, with nuts and washers; inserts; plates, and sleeves; required to attach miscellaneous metal items to masonry, for installation under Section 04 20 00 - UNIT MASONRY ASSEMBLIES.

C. Perform all drilling and cutting in miscellaneous metal items required for the attachment of other items.

D. Perform all drilling of structural steel elements for the attachment of steel fabrications of this section.

E. Perform all shop-painting for all surfaces of exposed to view galvanized and nongalvanized metals, and post-erection touch-up of shop prime coat, using the same material as shop-prime coating.

F. Perform application of liquid zinc touch-up to all welds of galvanized steel items furnished hereunder.

1.3 RELATED SECTIONS

A. Section 02 41 19 – SELECTIVE DEMOLITION
B. Section 04 20 00 - UNIT MASONRY ASSEMBLIES:
   1. for building in of lintels and anchors into masonry walls.
C. Section 05 40 00 - COLD FORMED METAL FRAMING: for structural stud framing.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.

   1. ASTM A 123 - Zinc Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
   2. ASTM A 153 - Zinc-Coating on Iron and Steel Hardware.
   3. ASTM A 283 - Carbon Steel Plates, Shapes, and Bars.
5. ASTM A 36 - Structural Steel.
8. AISI referenced standards.


1.5 SUBMITTALS
A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:
1. Shop drawings:
   a. Include large scale details of items of all metal fabrications to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.
   b. Indicate on the shop drawings all erection marks for various places of miscellaneous metals, and ensure that the actual field pieces bear corresponding marks.
2. Welders certificates.

1.6 EXAMINATION OF SITE AND DOCUMENTS
A. The bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Subcontractor's failure to familiarize themselves with the Contract Documents and site conditions. By submitting a bid, the bidder agrees and warrants that he has had the opportunity to examine the site and the contract documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the contract documents are adequate and that he will produce the required results.

1.7 QUALIFICATIONS
A. Fabricator, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 QUALITY ASSURANCE
A. Engineering: Provide the services of a Professional Structural Engineer, registered in the State of Connecticut to design and certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by Connecticut State Building Code.
B. Welders Certificates: Submit certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.11 EQUIPMENT
A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
1. This Sub-Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the work of this section. All such items shall meet the approval of the Owner but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the Associated General Contractors (AGC) and the standards of the State Labor Department.

B. Staging, exterior and interior, required for the execution of the work of this section, shall be furnished, erected, relocated if necessary and removed by this Sub-Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be new stock, free from defects impairing strength, durability or appearance, and of best commercial quality for each intended purpose. Unless specifically called for otherwise, work shall be fabricated from the following:

2. Steel shapes, plates and bars: ASTM Designation A 36.
3. Steel plates to be bent or cold-formed: ASTM A283, grade C.

B. Metal surfaces, general: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

C. Provide all fasteners and attachments of the same material and finish as the metal to which it is applied unless otherwise noted. Provide all fasteners and attachments as required for work specified herein and as indicated on the Drawings.

D. Welding rods: AWS E70XX grade, or select in accordance with AWS specifications for the metal alloy to be welded and in accordance with the recommendation of the welding rod manufacturer.

2.2 ACCESSORIES

A. Primer for non-galvanized steel surfaces, modified alkyd rust-inhibitive, high solids primer, equal to the following:

1. International (Courtaulds Coatings): Interlac 260HS.
5. Wibur & Williams (California Products Corporation): 1703 Universal Metal Primer.

2.3 FABRICATION - GENERAL

A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well formed and finished to shape and size, true to details with straight, sharp lines, and
angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.

B. Shop fabricate items wherever practicable, accurately fitting all parts and making all joints tight. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.

C. Do all cutting, punching, drilling, and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other trades. All such work shall be done prior to hot-dip galvanizing of the various components.

D. Grind all edges of plates completely free from nicks and machine marks, prior to shop priming.

E. Use screws and bolts of sufficient size to ensure against loosening from normal usage of miscellaneous metal items furnished hereunder.
   1. Countersink all screw heads and bolt heads as far as practicable. Use not less than two screw, bolts, or other anchorage items, at each connection point.
   2. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water.

F. Carefully coordinate the installation of metal fabrications with the work of trades responsible for the installation of interfacing work, and for the installation of work into the various assemblies furnished hereunder, and permit the installation of the related materials to be made at the appropriate times.

2.6 SHOP APPLIED COATINGS

A. Schedule: Shop applied coatings as scheduled at end of Section and as indicated on Drawings.

B. For steel surfaces:
   1. Surface preparation prior to priming: Thoroughly clean all steel of all loose mill scale by power wire brushing or sandblasting. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter by wire-brushing or scraping (power wire-brushing, if necessary). Grind smooth any sharp projections.
   2. Shop apply specified primers thoroughly and evenly on the surfaces and worked into the joints and other open areas on the surfaces. Surfaces inaccessible after assembly shall be given two coats. Dry film thickness of primer shall be not less than 2.4 mils per coat.

PART 3 - EXECUTION

3.1 ERECTION

A. Accurately set all work to established lines and elevations, and rigidly fasten in place with suitable attachments to the construction of the building. At the completion of the work, check all work, re-adjust as required, and leave in perfect condition. Grind all exposed to view welds smooth to the touch.

3.3 FIELD BOLTING

A. Accurately drive all bolts into holes, protecting the bolt heads so as not to damage the thread during the driving. Ensure that bolt heads and nuts rest squarely against the metal. Where structural members have sloping flange faces, provide approved beveled washers at the bolted connections to afford square seating for bolt heads or nuts. Nick bolt threads for unfinished bolts to prevent the nuts from backing off.
B. Use an approved calibrated manual or power torque wrench to obtain the proper torque and tension as recommended by the bolt manufacturer for all A 325 bolts.

END OF SECTION
***
PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, include General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Steel tube railings for interior.
2. Steel nickel plated handrails for interior.
3. Steel guardrails for interior.
4. Steel mesh infill panels.
5. Other accessories as required and as shown on drawings for detailing of complete stair and railing assemblies.

B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections

a. Anchors, plates and similar items.

Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 06 10 00 - ROUGH CARPENTRY for wood blocking for anchoring railings.
2. Section 09 29 00 - GYPSUM BOARD for metal backing for anchoring railings.
3. Section 09 91 00 - PAINTING for field painting work of this section.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Metal railings and handrails.
2. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Provide templates for anchors and bolts specified for installation under other Sections.

C. Delegated-Design Submittal: For railings indicated to comply with performance requirements and design criteria, including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
C. Woven-Wire Mesh, Carbon Steel: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.135-inch nominal diameter wire complying with ASTM A 510.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn, Select fasteners for type, grade, and class required.

2.4 MISCELLANEOUS MATERIALS AND FINISHES

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.
C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
   1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Nickel Plating of Handrails: Matt finish.

2.5 FABRICATION, GENERAL

A. Provide complete railing assemblies, including railings, clips, brackets, bearing plates, and other components necessary to support and anchor handrails and railings on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

G. Comply with “Guideline 1: Joint Finishes”, by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:

1. Typical Railing: Type 2 or better, unless otherwise indicated.
2. Ornamental Railing: Type 1.

2.6 TUBE RAILINGS

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
C. Form changes in direction of railings as detailed on the Drawings.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Interior Railings (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal guardrail and bracket components, except those to be embedded in concrete or otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Coordinate installation with riser installation. Install anchor plates with vertical pipe sleeves directly to concrete floor ready to receive railing assembly.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal railings. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

3.2 INSTALLING STEEL TUBE RAILINGS
A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

B. Attach handrails to wall and guardrails with brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
3. Do not install nickel plated handrails until guardrails and brackets have been finish painted by Section 09 90 00 Painting.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish and install the following:

1. Various wood blockings, edgings, nailers, curbs, cants, grounds, furring, sheathing, rough framing as required for supporting various finishes, surfacing, furnishing, or equipment for the Project whether or not specifically specified in other Sections. Exposed blocking, not protected by sheetrock, shall be fire retardant treated.

2. Fire retardant treated plywood backer panels for mounting of electrical panel boards, HVAC and fire control equipment and other equipment.

3. Curb blocking and related blocking for rear and sides of metal lockers. Wood nailer inserts at concrete base for anchoring metal lockers.

4. Various in-wall and above-ceiling wood blockings and nailers for anchoring and supporting various fixtures, equipment or devices specified elsewhere requiring blocking and nailers.

5. Rough installation hardware, including bolts, screws, spikes, nails, clips, and connection assemblies, as needed for installation of the rough carpentry work.

6. Pressure treated wood blocking as required for installation of all rooftop prefabricated equipment curbs and exterior door opening.

7. Provide plywood blocking in walls at all TV monitor locations and wood blocking at all toilet accessories.

8. Fire retardant treated plywood flooring at proposed risers.

B. Install the following furnished under the designated Sections:

1. Behind wall, above ceiling, below floor, and other concealed anchorage devices for handicap handrails in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.

C. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work. Furnish and install furring, blocking, and shims, and other usual items of normal rough carpentry work as required by the various trades for the proper completion of the project.

1. The applicable requirements specified in Part 1 - GENERAL and Part 3 - EXECUTION of the individual specification sections furnishing materials to be installed under this Section, shall be included in and made a part of this Section.

D. No attempt is made in this Section to list all elements of rough carpentry required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.
1.3 RELATED SECTIONS

A. Section 04 20 00 - UNIT MASONRY ASSEMBLIES: Building-in of hollow metal frame anchorage set into masonry and grouting of door frames.

B. Section 05 40 00 COLD FORMED METAL FRAMING: Fire retardant treated plywood flooring.

C. Section 05 51 00 METAL RAILINGS: Blocking for handrail support brackets.

D. Section 07 53 23 - EPDM ROOFING: Roofing insulation, fiber cants and membrane roofing system.

E. Section 08 11 13 - STEEL DOORS AND FRAMES: Furnishing hollow metal framing.

F. Section 09 22 00 - METAL SUPPORT ASSEMBLIES: Metal framing for drywall construction work.

G. Section 09 29 00 - GYPSUM BOARD: Wallboard construction work, having taped and compounded joint finish.

H. Section 09 91 00 - PAINTING: Applied primer and finish coatings to exposed to view rough carpentry work.

I. Section 10 28 13 - TOILET ACCESSORIES: Toilet accessories requiring in-wall blocking for mounting.

J. Section 10 51 13 – METAL LOCKERS: Blocking at metal locker bases.

K. Divisions 21, 22, 23 and 26: Mechanical and electrical devices and equipment requiring fire retardant plywood mounting panels, blockings, or curbs.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS & DEFINITIONS. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. EWA - applicable grades and specifications.


4. AWPA Standards and references for preservative treated wood including Standards C1, C9, C15, and P5

5. AWPA Standard C-20 - Structural Lumber Fire Retardent Treatment by Pressure Processes.

6. AWPA C-27 - Plywood, Fire Retardent Treatment by Pressure Processes.

7. AWPA M4 – Care Of Preservative Treated Wood Products.


11. UL - Building Materials Directory

12. US. Department of Commerce Voluntary Product Standard PS1 for Construction and Industrial

13. US. Department of Commerce Voluntary Product Standard PS2 for Wood-Based Structural-Use Panels.
15. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
16. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.


1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:
   1. Certifications: Written certification from the respective treatment plants indicating types of wood preservative treatment and fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
      a. Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
      b. Provide report from National Evaluation Service Committee on fire retardant treated wood flame spreading, strength, corrosion and hygroscopic properties.
      c. Provide report from National Evaluation Service Committee on pressure preservative treated wood strength, corrosion, anti-fungi, and anti-insect properties.

1.6 QUALITY ASSURANCE

A. All lumber shall:
   1. Be new, dressed four sides (S4S), clear and free from warping and other defects.
   2. Have a moisture content not exceeding 19 percent when delivered to the project.
   3. Be in accordance with the grading rules of the lumber manufacturer’s association under whose jurisdiction the lumber is produced and bear the mark of grade and mill identification.

B. Plywood: Conform to the requirements of Product Standard PS-1, and bear applicable EWA grade trademarks.
   1. Plywood for electrical boards and flooring treated for retardance, meet Class I or a flamespread rating of 25 or less and bear U.L. label "Classified FRS".

1.7 DELIVERY, STORAGE AND HANDLING

A. Store all materials in an elevated dry location, protected by waterproof coverings. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 BOARD AND SHEET MATERIALS

A. Lumber for blocking, nailers and curbs as indicated or required: Hem-Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried studor utility grade.
Wood members shall be of sizes indicated on the Drawings or of the same size as the members being braced.

B. Plywood and sheet products

1. For electric panel board mountings and similar uses: EWA graded B-D INT, Group 2 species, touch-sanded, fire-retardant treated, 3/4 inch thick, except as otherwise indicated on the Drawings.

2. For unspecified interior concealed from view locations: EWA graded C-D PLUGGED for sub-flooring, Group 2 species, fire-retardant treated, thickness as indicated on the Drawings.

3. For top layer of flooring: EWA graded B-D INT T&G Flooring, Group 2 species, touch-sanded, fire-retardant treated, thickness as indicated on the Drawings.

2.2 WOOD TREATMENTS

A. Treated wood products shall be produced by a single treatment plant, fully licensed by the chemical manufacturers, and conforming to the requirements specified herein.

1. Dye wood or otherwise color code all treated wood at treatment plant to clearly distinguish the different treatments in the field.

2. Kiln dry all treated lumber and plywood to the following maximum moisture content after treatment.
   a. Lumber: 19 percent.
   b. Plywood 15 percent.
   c. Discard pieces with defects which might impair quality of work.

3. Quality marks: Each piece of lumber and plywood shall be permanently affixed with a quality mark, containing the following information:
   a. Identification of the inspection agency.
   b. Standard to which material was treated.
   c. Identification of the treating plant.
   d. Fire retardant treated wood shall include: stamp signifying a FR-S rating
   e. Preservative treated wood shall include: Retention and end use for which product is suitable.

B. Fire Retardant Treated Wood.

1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
   a. Hickson Corporation, product, “Dricon”.
   b. Hoover Treated Wood Products, Inc., product “PyroGuard”.

2. Fire retardant treated wood shall comply with the following requirements:
   a. All fire-retardant lumber and plywood must have an Underwriters Laboratories stamp signifying a FR-S rating certifying a 25 or less flame spread and smoke developed value, when tested in accordance to ASTM E-84, or UBC Standard No. 42-1.
   b. Fire retardant chemical: Free of halogens, sulfates, ammonium phosphate and formaldehyde.
   c. Corrosion rates: Less than one mil per year for carbon steel, galvanized steel, aluminum, copper and red brass in contact with the fire retardant treated wood when tested in accordance with Federal Specification MIL-L-19140E Paragraph 4.6.5.2.
   d. The fire retardant treated wood must have equilibrium moisture content of not more than 25 percent when tested in accordance with ASTM D 3201 procedures.
at 95 percent relative humidity and 80 degrees Fahrenheit.

e. Fire retardant chemical: Registered for use as a wood preservative by the U.S. Environmental Protection Agency.

f. Testing: Fire performance and strength properties for both lumber and plywood, of the fire retardant treated wood shall be recognized by issuance of a National Evaluation Services Report. Fire retardant chemical must not damage the middle lamella of the wood structure when exposed to 170 degrees Fahrenheit and 90 percent relative humidity for 23 days.

C. Pressure Preservative Treated Wood.

1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Licensed products which may be incorporated in the work include:

   a. Chemical Specialties, Inc., product “SupraTimber”.
   b. Hickson Corporation, product, “Wolmanized Pressure Treated Wood”.
   c. Hoover Treated Wood Products, Inc., product “CCA Outside Wood”.

2. Treatment: Chromated Copper Arsenate (CCA) Type C in accordance with AWPA Standard P5, free of sodium and sulphates. Registered by the United States Environmental Protection Agency as a pesticide containing inorganic arsenic.

3. Minimum preservative retention:

   a. All pressure preservative treated lumber and plywood must have an ALSC-recognized agency Quality Mark signifying a chemical retention level of 0.25 pounds per cubic foot of oxide chemical, rated for “Above Ground Use”.

2.3 ACCESSORIES


B. Nails (interior and exterior): Galvanized common nails, of size and type to suit application and as required by state and local building codes.

C. Screws:

   1. Screws for interior applications: Flat head electroplated-galvanized wood screws of the appropriate sizes.
   2. Screws for exterior applications: Flat head hard aluminum, or stainless steel, wood screws, of the appropriate sizes.

D. Anchor bolts, expansion bolts and lag screws: Hot-dipped galvanized steel, of the following types:

   1. For lumber having actual thickness of 1-1/2 inches or greater to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, 3/8-inch minimum diameter, spaced as shown on drawings, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
   2. For lumber having actual thickness of greater than 7/8-inch but less than 1-1/2 inches to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, at least 1/4-inch diameter of the most appropriate lengths for the specific application, spaced as shown, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
   3. For lumber having actual thickness of 7/8-inch and less: Anchor bolts or expansion bolts, at least 1/4-inch in diameter; or screws, of the most appropriate sizes; in lengths most suitable for the specific application, countersunk, spaced, and staggered.
E. Protection paper: Canadian red-rosen paper or kraft paper.

PART 3 - EXECUTION

3.1 PREPARATION

A. All materials shall be inspected before use, with all checked, split and otherwise deficient stock rejected, or used only for miscellaneous blocking, furring or other incidental use. The Contractor shall be responsible for replacing all lumber which, due to warpage, twist, splitting, or checking, results in unsatisfactory work. Such replacement shall be required at any time, whether before or after application of finish material under other Sections.

B. Verify exact locations of toilet accessories, door stops and similar items with Architect prior to installation of blocking for accessories.

3.2 INSTALLATION - GENERAL

A. Closely coordinate the installation of the rough carpentry work with the work of other trades responsible for the installation of interfacing or overlaying materials, so as not to delay the work of the related trades.

B. Erect all rough carpentry work plumb, level, and true with tight, close fitting joints, securely attached and braced to surrounding construction, all in a first class workmanlike manner. Counterbore for bolt heads, nuts, and washers where required to avoid interference with other materials. Bear complete responsibility for structural integrity, connections, and anchorage of all rough carpentry work.

C. Use as long lengths as practicable for wood nailers, blockings, and curbs, to minimize number of joints, and attach the members with the types, and spacing, of fasteners specified herein.

D. Install blocking, grounds and furring, as required for proper attachment of the work of other trades, in accordance with the requirements provided by the respective related trades.
   1. Spacing for furring and strapping shall not exceed 16 inches on center.

E. Field cuts of fire retardent treated lumber: Do not rip or mill fire retardent treated lumber. Only end cuts, drilling holes and joining cuts are permitted.

F. Field cuts of inorganic arsenical pressure-treated lumber: Apply solution of copper naphthenate containing a minimum of 2 percent metallic copper in-solution, in accordance with AWPA standard M4. Brush liberally all cuts and holes.

G. Install concealed from view plywood with specified fasteners spaced not more than 10 inches on centers.

H. Install fire-treated plywood and boards with counter-sunk galvanized fasteners, of specified sizes, spaced not more than 12 inches on centers.

3.3 INSTALLATION - ROOF NAILERS AND BLOCKING

A. General: Provide anchorage for nailers as required for roof and edging to obtain FM Class A/I-90 rating, coordinate requirements with Section 07 31 13 – ASPHALT ROOF SHINGLES and Section 07 53 23 - EPDM ROOFING.
   1. Secure nailers and blocking to metal deck with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 3/4-inch below deck.
   2. Secure nailers and blocking to wood substrates with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 1-1/2 inch into board substrates and 3/4 inches into sheet materials.
B. When building up layers of nailers and blocking, fully secure each layer to at least the one below, alternating location of fasteners, spacing at 12 inches on center. Provide fasteners in lengths to penetrate through more than one substrate layer of blocking. Stagger locations of butt ends of boards, such that no two joints are “lined up”.

C. Ensure finished height of nailers is same as top surface of roof insulation within 1/4-inch, plus or minus.

D. Provide pressure-treated wood blocking (cut from 2x stock) on bottom of the curbs for all rooftop HVAC units and ductwork in order to provide a level base for setting the units. The wood blocking shall be wedge shaped with minimum dimension being 2" nominal. The wedge shaped blocking shall be mechanically secured to the rooftop structure. The prefabricated curbs shall be secured, through the wood blockings, to the structure components below. Coordinate with HVAC trade requirements for prefabricated curbs installation.

3.4 INSTALLATION – PLYWOOD BACK PANELS AND FLOORING

A. Provide panel mounting backboards for HVAC, fire prevention, electrical and telephone/data equipment. Fabricate panels using fire-retardant treated 3/4 inch thick panels mounted to fire-retardant treated 2x4’s. Provide a nominal space of 3-1/2 inches behind panels to permit wiring run.

B. Mount plywood sub-flooring and flooring and risers to fire-retardant treated 2x4’s mounted to cold-formed metal framing. Provide a layer of rosin paper between the flooring and sub-flooring.

3.5 TOLERANCES

A. Door frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

3.6 SCHEDULES

A. Wood treatment schedule:
   1. Pressure preservative treat all concealed or exposed-to-view:
      a. Lumber and plywood which comes in contact with concrete, masonry, or earth.
      b. Lumber and plywood nailers, blocking and curbing directly related to roofing, flashing, skylights, roof hatches, and roof accessories.
      c. Additional lumber and plywood locations indicated on Drawings.
   2. Fire retardent treat all equipment backer boards, concealed blocking and framing.

B. Wood blocking schedule: The following schedule lists common items for which blocking is required and may not be indicated in the Drawings. It is not the intention of this schedule to list all conditions requiring blocking or limit the extent of blocking required for completion of the Work; provide all wood blocking, edgings, nailers, required for receipt of various finishes and surfacing materials. Securely anchor wood blocking and run continuous between framing.

<table>
<thead>
<tr>
<th>Items</th>
<th>Nominal size of blocking with fastener notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mirror and shower rods</td>
<td>2 by 4 inch.</td>
</tr>
<tr>
<td>Soap dispensers</td>
<td>1 by 3 inch.</td>
</tr>
<tr>
<td>Paper towel dispensers</td>
<td>1 by 3 inch.</td>
</tr>
<tr>
<td>Toilet paper dispensers</td>
<td>2 by 4 inch.</td>
</tr>
<tr>
<td>Towel bars</td>
<td>2 by 6 inch, with 1/4 inch dia. toggle bolts.</td>
</tr>
<tr>
<td>Grab bars</td>
<td>2 by 6 inch, with 1/4 inch dia. toggle bolts.</td>
</tr>
<tr>
<td>Lavatories</td>
<td>2 by 8 inch, with 1/4 inch dia. toggle bolts.</td>
</tr>
<tr>
<td>Cubicle curtain track</td>
<td>2 by 4 inch.</td>
</tr>
<tr>
<td>Wall mounted door stops</td>
<td>1 by 3 inch.</td>
</tr>
</tbody>
</table>
Corner guards 2 by 4 inch.
Window shades, blinds 2 by 4 inch.

END OF SECTION
***
SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish and install the following:
   1. Acoustical insulation where indicated.
   2. Foamed-in-place insulation / vapor barrier sealant: applied to seal gaps, cracks, cavities and joints in the building envelope, at door frames, and other similar penetrations in exterior walls
   3. Rigid insulation for exterior wall construction.

1.3 RELATED SECTIONS

A. Section 03 30 00 – CAST-IN-PLACE CONCRETE: vapor barrier beneath concrete slabs-on-grade.

B. Section 05 40 00 – COLD FORMED METAL FRAMING: Stud walls to receive insulation.

C. Section 07 53 23 - ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING: New penetrations through existing roof.

D. Division 23 - HVAC: Ductwork and piping insulation.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS & DEFINITIONS.
   2. ASTM C 665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   3. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750∞C.
   7. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

1.5 DEFINITIONS
A. The "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.6 SUBMITTALS
A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:
   1. Literature: Manufacturer’s product data sheets, specifications, installation instructions, performance data, physical properties for each item furnished hereunder.
      a. Provide confirmation and data that shows all composite wood products meet the testing and product requirements of The California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.

1.7 DELIVERY, STORAGE AND HANDLING
A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
B. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.
   1. Rigid board insulation materials are combustible and may constitute a fire hazard, do not expose insulation materials to open flames or other ignition sources, comply fully with manufacturer’s recommendations and the requirements of local authorities having jurisdiction, for delivery, handling, storage and installation.

1.8 WARRANTY
A. Provide manufacturer’s standard warranty.
   1. Provide written warranty that the actual thermal resistance of the extruded polystyrene foam insulation will not vary by more than 10% from its published thermal resistance.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. Rigid insulation board (extruded polystyrene):
      a. Amoco Foam Products Company, Atlanta, GA.
      b. Dow Chemical Corp., Midland MI.
      c. UC Industries (Division of Owens-Corning), Parsippany, NJ.
   2. Glass fiber batt/blanket insulation:
      a. CertainTeed Corporation, Valley Forge PA.
      b. Owens Corning Fiberglas Corp., Toledo OH.
      c. Johns Manville Corp., Building Insulation Division, Denver CO.
      d. USG Corp./USG Interiors Inc., Chicago IL.
   3. Foamed-in-place insulation:
      a. BASF Corp., Polymers Div., Styropar Group, Parsippany NJ.
      b. Flexible Products Company (Division of Dow Chemical), Marietta GA.
c. Universal Protective Coatings, San Rafael CA.

4. Acoustical mineral fiber insulation:
   a. Fibrex Inc., Alexandria, IN.
   b. Rock Wool Manufacturing Company, Leeds, AL.
   c. USG Corp./USG Interiors Inc., Chicago IL.

2.2 MATERIALS

A. Rigid Insulation:

1. Rigid insulation board (extruded polystyrene): shall be closed cell rigid extruded polystyrene foam board insulation of thickness(es) as indicated with tongue and groove edge, self-extinguishing, conforming to ASTM C 578-87a, Type IV, with a compressive strength of 25 pounds per square inch when tested in accordance with ASTM D 1621 equal to Dow Chemical Corp., Styrofoam Brand or approved equal by Amoco Foam Products Company, Atlanta, GA, or UC Industries (Division of Owens-Corning), Parsippany, NJ.
   a. Surface burning characteristics:
      1) Flame Spread: 15.
      2) Smoke Developed: 165.

2. Veneer Cavity Insulation: Closed cell rigid extruded polystyrene foam board insulation, ship lapped edge, self-extinguishing, conforming to ASTM C 578-87a, Type IV, with a compressive strength of 25 pounds per square inch when tested in accordance with ASTM D 1621 equal to Dow Chemical Corp., Styrofoam Brand “Cavity Mate Ultra” insulation, or approved equal by Amoco Foam Products Company, Atlanta, GA, or UC Industries (Division of Owens-Corning), Parsippany, NJ.
   a. Size: 16 inches high by 96 inches long.
   b. Thickness: As indicated on Drawings.
   c. Surface burning characteristics:
      1) Flame Spread: 15.
      2) Smoke Developed: 165.

B. Acoustical batt insulation: Unfaced glass fiber insulation nominal 1 inch, 2 inches, 3-1/2 inches, and 5 inches thick as indicated on the Drawings conforming to ASTM C-665 Type I, Class C (non-thermal), of width appropriate for spacing of framing or furring members with which used.

C. Foamed-in-place insulation for vapor barrier sealant: UL Class I, two component polyurethane self frothing foam insulation equal to Flexible Products Company, product “Froth-Pak” having the following characteristics:
   1. Propellent: HCFC or HFC, No CFC’s are permitted.
   2. Apparent Density (ASTM D1622): 1.7 pounds per cubic foot. (with 1.75 pcf HCFC)
   3. Water Absorption (ASTM D2842): less than 2.5 percent water absorbed.
   4. Open cell content (D2856): less than 2 percent.
   5. Apparent aged (18 months) R value: 4.9 per inch.
   7. Flexural Strength, perpendicular (ASTM C203): 26 to 42 pounds per square inch.
   8. Flame Spread (ASTM E84): 25 or less (Class 1 rated).
   9. Smoke Developed (ASTM E84): 350 (Class 1 rated), tested for 2 inch depth.

2.3 ACCESSORIES

A. Note all adhesive materials are intended to be “Low VOC” products complying with LEED
Requirements and procedures.

B. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.

C. Building felt: Nº. 15 asphalt impregnated felt.

D. Adhesive for rigid insulation: Conforming with ASTM C-557-65T, type as recommended by insulation manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Verify that masonry joints are struck flush and that other conditions are satisfactory for proper installation.

3.2 INSTALLATION.

A. Acoustical insulation:
   1. Install insulation in accordance with insulation manufacturer's instructions.
   2. Install in interior walls, and ceiling spaces where indicated. Trim insulation neatly to fit spaces. Fit insulation tight in spaces. Leave no gaps or voids. Fill voids between metal decking and metal partition tracks.

B. Sheet polyethylene vapor barriers:
   1. Wherever the air and vapor barrier system is not called for, place vapor barrier on warm side of all thermal insulation in metal framed walls. Attach using commercial grade double stick tape. Lap and seal all sheet joints.
   2. Extend vapor barrier tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

C. Foamed-in-place insulation / vapor barrier sealant: Apply insulation in froth method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
   1. Apply application of foam seal for continuation of complete vapor barrier system, application conditions include, but is not limited to:
      a. Door frames, and similar penetrations in exterior walls.
      b. Gaps, cracks, cavities and joints in the building envelope, not sealed with other forms of air boots, including electrical boxes and conduit, ducts, fans, and piping.
      c. Where additionally indicated on Drawings.

3.3 CLEAN-UP

A. Remove and dispose of excess insulation, wrappings and other wastematerials.

END OF SECTION

***
PART 1 - GENERAL

1.1 GENERAL PROVISIONS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY
A. Modify existing EPDM roofing system to accommodate new roof equipment, new penetrations, exposed ductwork supports and exhaust fans.

1.3 RELATED WORK
A. Section 06 10 00 - ROUGH CARPENTRY: Pressure treated blocking, curbing and nailers.
B. Section 07 90 00 - JOINT SEALERS: Sealants other than those specified in this Section 07534.
C. Division 23 - HVAC: Prefabricated curbs for roof mounted mechanical equipment; various ductwork and piping penetrations.
K. Division 26 – ELECTRICAL: for roof mounted electrical devices; various conduit penetrations and photovoltaic systems.

1.4 REFERENCES
A. The following reference materials are hereby made a part of this Section by reference thereto:
   1. NRCA Roofing and Waterproofing Manual, latest printing.

1.5 SUBMITTALS
A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:
   1. Literature: Manufacturer’s product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
   2. Project roofing manufacturer and applicator’s qualifications, credentials, and project experience list of similar installations.
   3. Shop drawings:
      a. Large scale design details, minimum of 1-1/2 inch per foot scale, showing flashing conditions and penetrations. Details shall show dimensions of actual measurements taken at the project site and reflect actual conditions; manufacturer’s standard preprinted details shall not be accepted as substitute for shop drawings.
1.6 QUALIFICATIONS
A. Roofing manufacturer, with a minimum of 10 years documented experience demonstrating previously successful work of the type specified herein.
B. Roofing applicator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
C. Roofing applicator's foreman with a minimum of 5 years documented experience of the type specified herein, and trained by product manufacturer.

1.7 QUALITY ASSURANCE
A. All roofing materials and accessories shall meet or exceed the minimum quality standards specified in this Section and shall be provided and approved by the roofing system manufacturer. Any materials not manufacturer or provided by manufacturer shall have written approval from the manufacturer stating the materials are acceptable and are compatible with the other materials and systems required.
B. UL listing: Provide labeled materials which have been tested and listed by UL in "Building Materials Directory" for application indicated, with "Class A" rated materials/system for roof slopes shown.
C. Performance Requirements
   1. Above-deck roof components shall be engineered, fabricated and installed in accordance with requirements of FM 1-29 for performance requirements specified above.
   2. Provide roof-covering materials that bear FM approval markings on the packaging.
   3. Indicate that materials have been subjected to FM's examination and follow-up inspection services.
D. Fire performance characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction:
E. The roof system manufacturer's technical specifications shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer's written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer's minimum requirements for the provided warranty shall apply.

1.8 REGULATORY REQUIREMENTS
A. Roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class A" roof.
B. Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document shall govern.

1.10 DELIVERY, STORAGE AND HANDLING
A. Deliver materials in manufacturer’s original, unopened containers or packages with labels and package seals intact and legible.
B. Store all materials in accordance with the manufacturer's recommendations. Store rolled goods on clean, raised platforms. Store other materials in dry areas, protected from water and direct sunlight.
C. Do not expose stored curable roofing materials or accessories, including uncured flashing, adhesives, sealant and pourable sealer, to a constant temperature in excess of 80 degrees Fahrenheit.

D. Provide continuous protection of stored materials against deterioration for duration of project.

E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Apply roofing in dry weather; do not install roofing in inclement weather or when precipitation is predicted with greater than 20 percent possibility. B. Do not apply roofing membrane to damp or frozen deck surface.

C. Apply roofing when ambient temperature is above 40 degrees Fahrenheit.

1.14 EQUIPMENT

A. General:

1. This Sub-Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the work of this section. All such items shall meet the approval of the Owner but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the Associated General Contractors (AGC) and the standards of the State Labor Department.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Carlisle Syntec Systems, Carlisle PA.
2. Firestone Building Products Co., Carmel IN.
3. Johns Manville, Denver, CO.

B. To establish the design basis, quality standards and performance requirements, the following product description is based on "Fully Adhered Roofing System" as manufactured by Carlisle Syntec Systems, Carlisle PA. Equivalent system as produced by other specified manufacturers will be acceptable subject to Architect’s approval.

2.2 ROOFING MATERIALS

A. EPDM membrane: Ethylene propylene diene monomers formed into uniform, flexible sheets, complying with ASTM D 4637 and ANSI/RAMI PR-1.

1. Nominal Thickness: 60 mils.
2. Grade + Class: Grade 2 and Class SR
3. Exposed face color - black.
B. Overlayment (cover) Board: shall be 5/8 inch thick fiberglass-mat faced gypsum roof board “Dens-Deck Prime” as manufactured by Georgia-Pacific Building Products, 55 Park Place, Atlanta, GA; or “Securock” as manufactured by USG, or equal having the following min. features and acceptable by roofing manufacturer.
1. Thickness: 5/8 inch.
2. Width: 4 feet.
3. Length: 8 feet.
4. Weight: 2.5 psf.
5. Surfacing: Fiberglass mat with low perm coating.
7. Flute Span (ASTM E661): 8 inches.
8. Permeance (ASTM E96): Not more than 2 perms.
9. R-Value (ASTM C518): Not less than 0.67.

C. Sheet seaming system: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges.

D. Cant strips, tapered edge strips and flashing accessories: Types recommended by manufacturer of EPDM material, provided at locations indicated and at locations recommended by manufacturer, including adhesive tapes, flashing cements, and sealants.

E. Flashing material: Manufacturer's standard system compatible with flexible sheet membrane. Sheet flashing shall be 60-mil thick EPDM.

F. Bonding agent: Manufacturer’s standard Low Voc bonding adhesive.

2.3 INSULATION MATERIALS

A. General: Insulation shall match existing.

2.5 ACCESSORIES

B. Pressure-Sensitive RUSS: 45 mil thick, 6” wide strip of reinforced EPDM membrane with factory-applied 3” wide SecureTAPE.

C. Bonding adhesive shall be as recommended by manufacturer. Adhesive shall be compatible with all materials to which the elastomeric membrane is to be bonded.

D. Splicing cement and inseam sealant shall be as recommended by membrane manufacturer.
1. Seam tape / tape splice systems as provided by Firestone Roofing and Carlisle Roofing are acceptable alternatives to adhesive splice seaming.
2. In-seam sealant: Provide at all adhesive splice type seams, use sealant recommended by membrane manufacturer.

E. Lap sealant for sealing the exposed edge of the splices shall be trowel on gun consistency as recommended by membrane manufacturer.

F. Water cutoff mastic shall be as recommended by membrane manufacturer.

G. Night sealer shall be as recommended by membrane manufacturer.
H. Pourable sealer for preparation of decking shall be as recommended by membrane manufacturer.

I. Prefabricated elastomeric accessories (pipe seals, inside and outside comers, etc.) shall be as manufactured and recommended by membrane manufacturer.

J. Nailing Strips and Fasteners: Nailing strips shall be extruded rubber and fasteners shall be non-corrodible stainless steel.

K. Termination bars: Minimum 1/8 inch thick extruded aluminum, of channel profile with 1/4-inch legs and minimum overall width of 2 inches. Termination bar shall be factory punched to accept fasteners 6 inches on-center. Install with stainless steel screw fasteners.

L. Screws: Stainless steel fastener with fluorocarbon coating. Minimum thread diameter 0.22 inches and minimum shank diameter of 0.172 inches.

M. Miscellaneous materials: Best grade or quality approved by the roofing manufacturer for the specific application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

B. Verify edge nailers, curbs and penetrations are in place prior to roofing, so that the roof system can be installed as continuously as possible.

C. Verify the roof deck, and related surfaces are clean, smooth, flat, free of depressions, waves, or projections, properly sloped to drains, and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Any condition requiring correction or completion shall be corrected or completed prior to the installation of the roofing system. Notify Contractor of unacceptable conditions.

F. Do not proceed until defects are corrected.

G. Beginning of installation means acceptance of substrate and site conditions.

3.3 PREPARATION

A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

B. Carefully broom clean substrate immediately prior to roofing application.

C. Where surface joints at roof and wall substrates exceed 1/4-inch width, fill flush with surface with pourable sealer before proceeding with the installation.

3.4 EMERGENCY MATERIALS AND PROCEDURES

A. Maintain on site equipment and materials necessary to apply emergency temporary coverage in the event of sudden storms or inclement weather.
B. Roofing subcontractor is fully responsible for all damage due to water penetration occurring during the Work of this Section.

3.5 INSTALLATION - GENERAL

A. The entire work of this Section shall be performed in accordance with the best standards of practice relating to trades involved.

B. Follow local, state and federal regulations, safety standards and codes. When a conflict exists, the more restrictive document shall govern.

C. Follow insurance underwriter’s requirements acceptable for use with specified products or systems.

D. The roof system manufacturer’s Technical Specifications shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer’s written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer’s minimum requirements for the provided warranty shall apply.

E. Review all special conditions, such as at projections, at connections to sheet metal gravel stops, flashings, etc. with the Roofing Manufacturer, submit the Roofing Manufacturer’s recommendations and details to the Architect for approval.

F. Special Cautions:
   1. Do not use oil-based or plastic roof cement.
   2. Do not subject elastomeric materials to contact with petroleum, grease, oil, solvents, vegetable or mineral oil, nor animal fat. Prevent contact with hot pipes, and ducts.
   3. Cements and bonding adhesive contain petroleum distillates and are extremely volatile and flammable. Avoid breathing vapors and do not use near fire or flame.
   4. Ensure that splicing and bonding surfaces are dry during installation.

3.6 ROOFING REMOVAL

A. Remove sections of roofing down to metal decking in areas where work is to be performed. Coordinate removal with other trades and provide temporary coverings until work is completed. Metal decking will be removed by Section 02 41 19 Selective Demolition.

3.6 INSULATION INSTALLATION

A. Replace any insulation damaged during the course of the work.

3.7 MEMBRANE ADHERED INSTALLATION

A. Provide membrane securement at the perimeter of curbs, and similar roof top penetrations, and at any angle change which exceeds 2 inches in one horizontal foot.
   1. Install continuous reinforcement strips 3 inches to 6 inches from inside and outside corners where additional membrane securement is required and where recommended by roofing manufacturer. Secure reinforcement strips with 2 -inch diameter aluminum or stainless steel seam fastening plates; space fastening plates not greater than 12 inches on center.
   2. Install reinforcement strips either horizontally into deck or vertically into curbs as recommended by roofing manufacturer.
B. Extend membrane up a minimum of 8 inches onto vertical surfaces.

C. Install termination bars with screw fasteners and EPDM or neoprene washers, located 6 inches on center. Install roofing manufacturer’s recommended sealant along top and bottom edges of termination bar.

D. Seal membrane around roof penetrations.

E. Provide daily night seal at loose edges to prevent water flow beneath finished roofing.
   1. Mix sealer components as instructed by manufacturer. Apply at rate of 1 gallon/100 linear foot, 12 inch. back from sheet edges on exposed substrate.
      a. Embed membrane in sealer and apply continuous pressure with 2-1/2 inch tubing filled with sand. Pull sheet free before continuing permanent installation.

3.8 INSTALLATION - ELASTOMERIC FLASHINGS

A. Elastomeric Flashings. Provide elastomeric sheet flashings at elastomeric sheet roofing work, as indicated (also referred to on Drawings as “Membrane Flashings”).
   1. Use longest practical lengths and widths of elastomeric sheet flashing material to eliminate or minimize joints. Complete splices between flashings and main-roof sheet before bonding flashings to vertical surfaces. Splices shall be sealed 3 inches beyond fasteners that attach membrane to horizontal nailer in same manner as splices within roofing membrane. Flashings shall be bonded 100 percent to subsurfaces, except at coves where movement is anticipated.
      a. Install flexible tube at coves where movement is anticipated.
      2. Apply bonding adhesive to flashing and surface to which it is being bonded. When bonding adhesive has dried to the point where it does not string or stick to a dry finger touch, roll flashing into adhesive. Do not bridge flashing at changes of direction.
      3. Nail top of flashing 12 inches on center under sheet metal copings, counter flashing, and other sheet metal work.

3.8 FIELD QUALITY CONTROL

A. Contractor shall correct all deficiencies in roof as determined by roof sample analysis and as prescribed by roof system manufacturer. Should additional samples be required, these cost will be borne by the Contractor.

B. Prior to installation of roofing membrane, obtain an independent testing agency approved by the Architect and test six fasteners for each separate substrate area pull out resistance. Report findings to Architect and the roofing manufacturer. Perform and repeat failed testing without additional cost to the Contract.

3.9 CLEANING

A. Remove elastomeric adhesive markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

C. Repair or replace defaced, or disfigured finishes caused by the work of this Section.

3.11 PROTECTION

Provide special protection or avoid traffic on completed work. Restore to original condition, or replace, work and roofing materials damaged.

END OF SECTION

***

ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING
07 53 23 - 7
PROJECT No. 056-0052 A / 01/07/2022
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General Requirements, apply to the work of this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish and install fireproof firestopping, firesafing materials, smoke seals and related accessories required for this Project for all penetrations through fire resistance rated construction, including, but not limited to, penetrations for plumbing, fire suppression, heating, ventilating and air conditioning, electrical systems, and specialized equipment.

1. Fire resistance rated construction requiring firestopping includes, but is not limited to: floors, rated walls and partitions, smoke barriers, smoke partitions, partitions in rated corridors, passageways and stairs, shaft partitions, shaft wall (vertical and horizontal), area separation fire walls, party wall systems, and temporary fire resistant rated partitions and barriers.

2. Provide removable temporary firestopping (pillows) as required to maintain fire integrity prior to Owner’s final acceptance, to permit installation of electrical, telephone, data and sound system wiring. Replace temporary firestopping with permanent, after wiring systems are completed.

B. Furnish and install firestopping/smoke seals at construction joints occurring at tops of fire resistance rated partitions, smoke partitions, and temporary partitions between top of partition and underside of deck above.

C. Furnish and install all firestopping, firesafing, and smoke seals at perimeter of floor/roof construction and exterior wall systems, as indicated and where required by applicable codes.

D. Furnish and install all firestopping, firesafing, and smoke seals at expansion joints in chase walls where expansion joints are not exposed to view.

E. Furnish and install all firestopping, firesafing, and smoke seals where required by applicable codes and as additionally required by authorities having jurisdiction at no additional cost to the Owner.

1.3 RELATED SECTIONS

A. Section 04 20 00 - UNIT MASONRY ASSEMBLIES: for rated masonry construction.

B. Section 05 30 00 - METAL DECKING: for rated metal floor deck and roof deck.

C. Section 09 29 00 - GYPSUM BOARD: for rated gypsum board wall and ceiling construction.

D. Division 21 – FIRE SUPPRESSION: for fire protection system penetrations through fire resistance rated construction.

E. Division 22 - PLUMBING: for plumbing penetrations through fire resistance rated construction.
F. **Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:** for heating, ventilating and air conditioning system penetrations through floors and fire resistance rated construction.

G. **Division 26 - ELECTRICAL:** Electrical penetrations through fire resistance rated construction.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.

5. UL - Fire Resistance Directory


1.5 PERFORMANCE REQUIREMENTS

A. Provide materials and work to conform to Building Code Requirements in fire resistant wall and floor assemblies.

B. Manufacturer’s certified product test requirements:

1. All firestop/smokeseal material shall be tested by a recognized, independent testing agency and shall conform to both Flame (F-rating) and Temperature (T-rating) requirements of ASTM E-814.
2. Conform to UL Fire Hazard Classification Requirements.
3. Tested and classified non-combustible per ASTM E-84.

C. Firestops in place shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.

D. Non-combustible dams shall be constructed:

1. As necessary to achieve fire rating as tested and rated.
2. In conformance with installation requirements for type of floor, wall, and partition construction.
3. As recommended by firestop/smokeseal manufacturer.

E. Combustible damming materials, if used, must be removed after proper curing.

1.6 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:

1. Literature: Manufacturer’s product data sheets, specifications, performance data, and physical properties.
a. Indicate requirements for manufacturer’s descriptive data for products and related materials with FM, UL or Warnock-Hersey illustrations showing systems and approval of materials in systems.

2. Certification: Manufacturer’s written certification stating that firestopping materials, meet or exceed the requirements specified under this Section and that all fire-resistant requirements for the indicated combustibility, Flame (F-rating) and Temperature (T-rating) Ratings have been met.

3. Manufacturer’s installation instructions.

4. Test reports: Submit fire test reports from recognized, independent testing agent(s) indicating the following:
   a. Fire test report of firestop material applied to substrate and penetration materials similar to project conditions. Tests to indicate both Flame (F-rating) and Temperature (T-rating) Ratings.
   b. Test reports of products to be used shall indicate conformance to ASTM E-814.

5. On-site sample installation to be included in Work: Minimum thirty days prior to application in any area, provide samples of firestop and smokeseal materials and installation in accordance with the following requirements.
   a. Apply one sample of appropriate firestop and smokeseal material for each different penetration and fire rating required for the work.
   b. Sample areas will comply with thickness, fire resistance ratings, and finished appearance of the project and applicable fire code.
   c. Acceptance samples will constitute standard of acceptance for method of application, thickness, and finished appearance for firestop and smokeseal application. The sample(s) shall remain visible during completion of the work and shall remain as part of the completed work.

6. Shop drawings indicating requirements for penetrations in wall/deck intersections, change of planes, control joints, expansion joints and blank openings.

B. Submit manufacturer’s warranties, maintenance data and bonds under provisions of Section 01 78 30 – Warranties and Bonds. The warranty period shall not be less than 18 months from the date of Substantial Completion.

1.7 QUALITY ASSURANCE

A. Obtain firestop and smokeseal products from a single manufacturer, except as otherwise approved by Architect.

B. Special Inspections: Allow for 3 percent of each type of firestopping system to be removed and inspected for conformance with approved submittals.
   1. All firestopping shall be inspected prior to installation of suspended ceilings or concealed by other materials.

1.8 QUALIFICATIONS

A. Installer, a specialized firesafing subcontractor having not less than 3 years documented experience demonstrating previously successful work of the type specified herein.
   1. The manufacturer of the firestop material shall submit written certification that the firm to be used for the firestop products has been trained in the application of the products by the manufacturer.

1.9 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire resistance ratings and surface burning characteristics.
B. Obtain certificate of compliance from authority having jurisdiction indicating approval of combustibility.

1.10 MOCK-UPS

A. Provide mock-ups under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying quality of firestop installation

B. Provide firestop samples and locate as directed. Accepted samples may remain as part of the work.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver and store firestopping materials in original, sealed, packages showing manufacturer's identification and date of packaging.

B. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. Bio Fireshield, Inc., Concord, MA.
   2. ‘Dow Corning Corporation, Midland, MI.
   3. 3M Company, Saint Paul, MN.
   5. Metacaulk, (The Rectorseal Corporation), Houston TX.
   6. Tremco, Inc., Cumberland RI.

2.2 MATERIALS

A. Firestop mortar: asbestos free, cementitious mortar, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM/UL1479.
   1. Acceptable products, or as approved:
      c. 3M Company, product “xxx”.
      d. Tremco Inc., product “Tremstop M”.

B. Silicone Firestop sealant: Single component, non-combustible silicone elastomer firestop sealant, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
   1. Acceptable products, or as approved:
      a. Bio Fireshield, Inc., product product “Biotherm 100” (Gun Grade) or “Biotherm 200” (Self Leveling).
      b. Specified Technologies, Inc., product “Spec Seal Pensil 300 Sealant (gun grade)” or “Spec Seal Pensil 300SL” (Self Leveling).
      c. 3M Company, product “Fire Barrier Silicone Sealants”.
      d. Tremco Inc., product product “Tremsil” (Gun Grade) or “Tremsil S/L” (Self Leveling).
2. Sealants will not dissolve in water.

C. Intumescent firestop sealant and caulks: Acrylic based, water resistant sealant, which will not re-emulsify after drying.
   1. Acceptable products, or as approved:
      a. Bio Fireshield, Inc., product "Biostop 500".
      b. Specified Technologies, Inc., product "Spec Seal S100 and S500 Sealant".
      c. 3M Company, product "Fire Barrier Caulk CP25WB+".
      d. Tremco Inc., product "Tremstop 1A".

D. Firestop putty: sticks or pads.
   1. Acceptable products, or as approved:
      b. Specified Technologies, Inc., product "Spec Seal Putty Bars and Pads".
      c. 3M Company, product "Fire Barrier Moldable Putty".
      d. Tremco Inc., product "Flowable Putty".

E. Firestop collars: Pre-manufactured fire protective pipe sleeve, UL classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
   1. Provide separated (two piece) firestop collar for application when plastic pipe system is already in place. Provide non-separated firestop collar for application prior to installation of plastic pipe system.
   2. Acceptable products, or as approved:
      a. 3M Company, Inc., product "Fireshield Firestop Sleeve"
      b. Specified Technologies, Inc., product "Spec Seal Collars".
      c. 3M Company, product "Fire Barrier PPD’s".
      d. Tremco Inc., product "Fyrecan sleeve".

F. Firestop pillows: UL Classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
   1. Acceptable products, or as approved:
      a. Bio Fireshield, Inc., product "Fireshield Firestop Pillows"
      b. Specified Technologies, Inc., product "Spec Seal Pillows".
      c. Tremco Inc., product "Tremstop P.S.".

G. Wrap strips:
   1. Acceptable products, or as approved:
      b. Specified Technologies, Inc., product “Spec Seal Wrap Strip”.
      c. 3M Company, product “Fire Barrier FS195 Wrap Strip”.
      d. Tremco Inc., product “Tremco W.S.”.

H. Mineral fiber / ceramic wool non-combustible insulation (fire safing): Provide US Gypsum Company product “Thermafiber” having a minimum density of 4 pounds per cubic foot, Fibrex product “FBX Safing Insulation” having a minimum density of 4 pounds per cubic foot, or provide Manville Corporation product “Ceramic Fiber Insulation” having a minimum density of 6 pounds per cubic foot, or approved equal product to suit conditions and complying with firestop manufacturer’s requirements.
1. Provide galvanized steel safing clips as required for installation of insulation.
2. Material shall be classified non-combustible per ASTM E-814.

I. Elastomeric Firestopping: Non halogenated latex based elastomeric coating applied by airless spray, Specified Technologies, Inc., product “Spec Seal Elastomeric Firestop Spray”.

2.3 ACCESSORIES

A. Forming and damming materials: Mineral fiberboard or other type as recommended by firestopping manufacturer.
B. Primer, sealant and solvents: As recommended by manufacturer.
C. Woven wire mesh: Galvanized 20 gage woven wire mesh “chicken wire” or “poultry fencing”, 1 inch spacing.

PART 3 - EXECUTION

3.1 COMMISSIONING OF COMPONENTS AND SYSTEMS

A. Engage a manufacturer authorized representative who is familiar with this project, to participate and assist as necessary, observing installation deficiencies of the components and systems included in this Division when requested by the Commissioning Authority.

3.2 INSPECTION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface to receive firestops shall be free of dirt, dust, grease, oil, form release agents, or other matter that would impair the bond of the firestop material to the substrate or penetrating item(s).
B. Voids and cracks in substrate shall be filled and unnecessary projection removed prior to installation of firestops.
C. All penetrating items shall be permanently installed prior to firestop installation.
D. Substrate shall be frost, free and, when applicable, dry.

3.4 INSTALLATION

A. General
1. Installation of firestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations. Meet building code requirements.
3. Coordinate with plumbing, mechanical, electrical, and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestops, schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of firestops.
a. Ensure that all firestopping is inspected prior to installation of suspended ceilings or concealed by other finished materials.

B. Dam construction
1. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming material may be left as a permanent component of the firestop system.
2. Placement of dams shall not interfere with function or adversely affect the appearance of adjacent construction.

C. Installation of single component silicone firestop
1. Apply with manual or powered caulking gun.
2. Apply minimum 1/2 inch thickness for 3 hour rating. Apply 1/2 inch to both sides of wall penetrations; one side only in floor penetrations.
3. Use incombustible insulation as required to achieve fire resistance rating.
4. Surface of gun grade silicone firestop may be tooled using clean, potable water.
5. Clean excess material off of adjacent surfaces and tools within 10 minutes using either water or Xylol where the use of such would not be hazardous.

D. Installation of cementitious firestop mortar.
1. Add dry powder to water and mix with mechanical mixer or hand mixing tools as recommended by firestop mortar manufacturer. Allow a average mixing time is 3 minutes and provide a average wet density of 70 pounds per cubic foot, plus or minus 5 PCF.
2. Do not apply if ambient or substrate temperature is less than 35 degrees Fahrenheit during 24 hours after application.
3. Wet all surfaces prior to application of firestop mortar.
4. Mortar may be hand applied or pumped into the opening.
5. Exposed surfaces shall be finished using conventional plastering tools prior to curing.
6. When installation around layered cables, it is recommended to increase the fluidity of the firestop mortar to provide a better fill around the cables. Vibrate or move the cables slightly to prevent voids from forming between the cables.
7. Allow 48 hours for initial cure prior to form removal. For full cure allow 27 days.
8. Wet material may be cleaned with water. Dry material may require scraping or chipping.

E. Installation of firestop collars (plastic pipe only)
1. Firestop collars may be surface mounted to a slab or wall or imbedded in Firestop Mortar to a maximum depth of 2 inches.
2. For wall penetrations with ABS pipe firestop collars must be installed on both sides of the penetration to provide a 3 hour F and T Rating. All other applications required installation on one side only to provide a 3 hour F and T Rating.

F. Firesafing insulation: Install firestopping safing insulation on safing clips spaced as needed between each stud and floor slab, leaving no voids. Secure safing clips to slab using fasteners recommended by insulation manufacturer. Install sealant over mineral wool in accordance with test requirements.

3.5 SCHEDULE
A. General: Typical penetrations are indicated below with list of standard firestopping approaches. Actual firestopping materials and combination of materials will vary with size of penetration and with individual firestopping manufacturer’s approved UL Design System
Requirements. Use only UL Design System materials for each penetration that best matches the wall and floor construction.

1. Where penetrations occur for which no listed UL or WH Design System test exists, obtain from the firestop system manufacturer an engineered system acceptable to the authorities having jurisdiction for firestopping such penetrations. Engineered system from manufacturer shall include a detail drawing showing the engineered system and shall contain no disclaimers.

B. Single metal pipe (non-insulated) and conduit penetrations through floors:
   1. Firestop mortar.
   2. Silicone Firestop sealant.
   3. Intumescent firestop sealant.
   4. Firestop putty, sticks or pads.
   5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.

C. Single metal pipe (non-insulated) and conduit penetrations through walls:
   1. (masonry and concrete walls only) Firestop mortar and putty.
   2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   3. Intumescent firestop sealant with wrap strips.

D. Multiple metal pipe and conduit penetrations through floors:
   1. Firestop mortar and wrap strips.
   2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).

E. Multiple metal pipe and conduit penetrations through walls:
   1. Firestop mortar and putty.
   2. (through masonry walls only) Firestop pillows with woven wire mesh.
   3. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).

F. Insulated metal pipe penetrations through floors:
   1. Firestop mortar and wrap strips.
   2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   4. Silicone Firestop sealant over wrap strip
   5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.

G. Insulated metal pipe penetrations (single and multiple) through walls:
   1. Firestop mortar with wrap strips.
   2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and Wrap strips.
   4. (multiple penetrations through masonry walls only) Firestop pillows with woven wire mesh.
H. Duct penetrations through floors or walls:
   1. Rectangular and square ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing), and steel flanges provided under Division 15.

I. Combustible plastic pipe and conduit penetrations through floors:
   1. Firestop mortar with wrap strips.
   2. Firestop mortar with firestop putty and firestop collars.
   3. Silicone firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   4. Silicone firestop sealant and firestop collars.
   5. Intumescent firestop sealant and firestop collars.
   6. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with firestop collars.
   7. (maximum pipe size 2 inches) Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with wrap strips.

J. Combustible plastic pipe and conduit penetrations through walls:
   1. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   2. Intumescent firestop sealant with firestop collars.

K. Blank openings:
   1. Firestop mortar.
   2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).

L. Fire rated joints:
   1. Silicone Firestop sealant over backer rod or bond breaker.

M. Construction joints at head of wall/floor assemblies:
   1. Silicone Firestop sealant/mastic over mineral fiber / ceramic wool non-combustible insulation (fire safing).
   2. Elastomeric spray over mineral fiber / ceramic wool non-combustible insulation (fire safing).

N. Smoke barrier sealant for dampers, fire door frames:
   1. Silicone Firestop sealant.

O. Temporary sealing of openings and penetrations:
   1. Firestop putty, sticks or pads.
   2. Firestop pillows.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General Requirements, apply to the work of this Section.
B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY
A. Prepare sealant substrate surfaces.
B. Furnish and install sealant and backing.

1.3 RELATED SECTIONS
A. Section 04 20 00 - UNIT MASONRY ASSEMBLIES.
B. Section 08 11 13 – STEEL DOORS AND FRAMES
C. Section 08 81 00 - Glass GLAZING: Sealants used in conjunction with glazing.
D. Section 09 29 00 - GYPSUM BOARD: Application of concealed acoustical sealant used in conjunction with gypsum board work.
E. Section 09 30 13 – CERAMIC TILE.
F. Section 09 77 03 – FIBERGLASS REINFORCED PLASTIC WALL PANELS.
G. Section 09 91 00 - PAINTING: Caulks used in preparation of applied Finish Coatings.
H. Section 32 13 73 – CONCRETE PAVING JOINT SEALANTS.

1.4 REFERENCES
A. The standards referenced herein are included to establish recognized quality only. Equivalent quality and testing standards will acceptable subject to their timely submission, review and acceptance by the Architect.
B. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.
1. ASTM C 717 - Terms Relating to Building Seals and Sealants.
2. ASTM C 790 - Use of Latex Sealing Compounds
3. ASTM C 804 - Use of Solvent-Release Type Sealants.
4. ASTM C 834 - Latex Sealing Compounds.
5. ASTM C 919 - Use of Sealants in Acoustical Applications.
7. ASTM C 962 - Use of Elastomeric Joint Sealants.
8. ASTM C 1085 - Butyl Rubber Based Solvent Release Sealants.
11. FS TT-S-00227E - Sealing Compound: Elastomeric Type, Multi-Component.
12. FS TT-S-00230C - Sealing Compound: Elastomeric Type, Single-Component
15. FS TT-S-001657 - Sealing Compound, Single Component, Butyl Rubber Based, solvent Release Type.

C. The following reference materials are hereby made a part of this Section by reference thereto:

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:
   1. Literature: Manufacturer's product data sheets, specifications, performance data, chemical and physical properties and installation instructions for each item furnished hereunder.
      a. Provide confirmation and data that shows all sealants and adhesives meet the testing and product requirements of The California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.
   2. Manufacturer's certification that the Products supplied meet or exceed specified requirements.
   3. Compatibility and adhesion test reports: Test reports from sealant manufacturer indicating that sealant proposed for use have been tested for compatibility and adhesion with actual samples of substrates to be used on this project. Include sealant manufacturer's interpretation of test results, and recommendations for primers and substrate preparation specific to this project
   4. Selection samples: Sample card indicating Manufacturer’s full range of colors available for selection by Architect
   5. Verification samples: 12 inch long samples of sealant for verification of color, installed where directed by Architect.

1.6 QUALITY ASSURANCE

A. Applicator specializing in applying the work of this Section with a minimum of 3 years documented experience approved by sealant manufacturer.

B. Obtain joint sealers from a single manufacturer for each type specified. Conform to SWRI requirements for installation.
1.7 DELIVERY, STORAGE AND HANDLING

A. Each container and package must bear an unbroken seal, test number and label of the manufacturer upon delivery to the site. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Architect and his requiring its removal from the site. New material conforming to said requirements, shall be promptly furnished at no additional cost to the Contract.

1.8 PROJECT CONDITIONS

A. Do not install single component solvent curing sealant in enclosed building spaces.

B. Environmental Requirements: Maintain temperature and humidity recommended by the sealant manufacturer during and 24 hours after installation. Do not proceed with installation of joint sealers under the following conditions:
   1. When ambient and substrate temperature conditions are below 40 degrees F.
   2. When joint substrates are wet due to rain, frost, condensation, or other causes.

C. Do not proceed with installation of joint sealers until contaminates capable of interfering with their adhesion are removed from substrates.

1.9 WARRANTY

A. Provide 5 year warranty under provisions of Section 01 78 30 – “Warranties and Bonds”. Warranty shall include coverage of installed sealant and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

1.10 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

   1. This Sub-Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the work of this section. All such items shall meet the approval of the Owner but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the Associated General Contractors (AGC) and the standards of the State Labor Department.

B. Staging, exterior and interior, required for the execution of the work of this section, shall be furnished, erected, relocated if necessary and removed by this Sub-Contractor. Staging shall be maintained in a safe condition without charge to and for the use of all trades as needed.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

A. Note all sealants are intended to be “Low VOC” products complying with High Performance Building Compliance Requirements and procedures.

B. Joint Sealer Type AA (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.

JOINT SEALERS
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1. Tremco, Beachwood OH.; product, “Acoustical Sealant”.
2. United States Gypsum Company, Chicago IL.; product “USG Acoustical Sealant”.
3. Pecora Corporation, Harleysville PA.; product “AC-20 FTR”.

C. Joint Sealer Type AP (Acrylic painters caulk): One component acrylic latex caulking compound, conforming to FS 19-TP-21M and ASTM C 834, paintable within 24 hours after application, with a minimum movement capability of plus minus 12.5 percent, equal to one of the following:
   2. Tremco, Beachwood OH.; product, “Trimflex 834,” “Tremflex 834”.
   4. Pecora Corporation, Harleysville PA.; product “AC-20+”.

D. Joint Sealer Type B (Butyl): Gun-grade modified butyl and polyisobutylene sealant, conforming to FS TT-S-001657, Type I, and ASTM C-834, with a movement capability of ±10 percent or better and a Shore A hardness of 24 to 28, equal to one of the following:
   1. Tremco, Beachwood OH.; product, “Butyl Sealant”.
   2. Pecora Corporation, Harleysville PA.; product “BC-158”.

E. Joint Sealer Type HL1 (Horizontal-self-Leveling, 1-component): Pouring grade self-leveling modified urethane sealant, conforming to FS TT-S-000230C, Type I, Class A, and ASTM C 920 Type S, Grade P, Class 25, with a minimum movement capability of ±25 percent, equal to the following:
   1. Tremco, Beachwood, OH., product “Vulkem 45/45SSL”
   2. Sonneborn Building Products Inc., Minneapolis MN.; product, “SL1”.

F. Joint Sealer Type P2 (Polyurethane, Multi-component): Low modulus type, Multicomponent non-sagging gun-grade polyurethane sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT, M, A and O with a minimum movement capability of ±50 percent, equal to the following:
   2. Tremco, Beachwood OH.; product, “Dymonic 240FC”.
   3. Pecora Corporation, Harleysville PA.; product “Dynatrol II”.

G. Joint Sealer Type SC (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, use NT, G, A, M, O with a minimum movement capability of ±50 percent, equal to the following:
   1. Dow Corning Corporation, Midland MI.; product, “791”.
   4. Tremco, Beachwood OH.; product, “Spectrem 2”.
   5. Pecora Corporation, Harleysville PA.; product, “895”.

H. Joint Sealer Type SE (Silicone, Exterior construction): One-part low modulus, moisture curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 25, FS TT-S-001543A, Type, Class A with a minimum movement capability of +100 percent and -50 percent, equal to the following:
   1. Dow Corning Corporation, Midland MI.; product, “790”.
   2. Tremco, Beachwood OH.; product, “Spectrem 2”.

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Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxy silicone rubber, mildew resistant, acceptable to local health officials, conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, FS TT-S-001543A, Type NonSag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ±25 percent, and a Shore A hardness of 20, equal to the following:
1. Dow Corning Corporation, Midland MI.; product, “786”.
4. Tremco, Beachwood OH.; product, “Tremsil 200”.
5. Pecora Corporation, Harleysville PA.; product “898”.

2.2 ACCESSORIES
A. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin foam or polyurethane foam rod, 1/3 greater in diameter than width of joint. Shape and size of compressible back-up shall be as recommended by manufacturer for the specific condition used. Provide one of the following, or equal. (only closed cell rods will be considered)
B. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
C. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
B. Beginning of installation means acceptance of substrates and site conditions.

3.2 PREPARATION
A. Weather conditions must be dry and of the temperature, as recommended by sealant manufacturer, during application operations.
B. Surface receiving work of this section must be absolutely dry and dust free. All joints receiving sealant and caulking materials and be subject to the approval of the material manufacturer for proper use of the specified materials.
C. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
1. Clean ferrous metals of all rust and coatings by wire brush, grinding or sandblasting. Remove oil, grease and protective coatings with cleaners recommended by sealant manufacturer.
D. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.

E. Verify that joint backing and release tapes are compatible with sealant.

F. Perform preparation in accordance with ASTM C 804 and C 790 for solvent and latex base solvents, respectively.

3.3 INSTALLATION

A. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.

1. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.

2. Do not stretch back-up material into joints.

B. Install bond breaker in joints where shown in the Drawings and wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.

C. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.

D. Apply urethane sealant and latex caulking materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.

1. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.

2. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.

3. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.

4. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.

5. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

E. Take care not to block-off weep tubes or any through wall opening constructed to allow weeping of accumulated water.

F. Apply pouring self-leveling urethane sealant (Sealant designation HL) into horizontal joints in accordance with manufacturer's instructions, to a level approximately 1/16 inch below adjacent surfaces.

1. Apply sealant without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.

2. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.

3. Remove the temporary masking tape immediately after tooling, and before the sealant has taken initial set.
3.5 CLEANING
A. Clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealant and caulking materials with solvents which will not damage the surfaces in any way.

3.6 PROTECTION
A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.7 SCHEDULE
A. General: Seal joints indicated and all interior and exterior joints, seams, and intersections between dissimilar materials.

B. Sealant Colors:
1. Colors for Sealant Types “P2” and “HL1”: Match colors furnished by the Architect, or match other building materials as directed. Should such custom colors not be available from the approved manufacturer, except at additional charge, provide all such colors at no change in Contract Sum.
   a. Sealants in masonry construction shall be closely matched to adjacent brick color.
2. Colors for Sealant Types “P1”, “HL1”, “SC”, “SE”, and “SM”: As selected by the Architect from manufacturer’s standard colors.
3. Color for Sealant Types “AA” and “AP”: White.
4. Color for Sealant Type “B”: Black
5. In concealed installation, and in partially or fully exposed installation where so approved by the Architect, standard gray or black sealant may be used.

C. Exterior joints (Listed by primary building material abutting sealant joints):
1. Concrete (including precast):
   . Concrete to all items which penetrate exterior concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:
   P1
2. Exterior Masonry:
<table>
<thead>
<tr>
<th>Joint Condition</th>
<th>SEALANT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Masonry to abutting non-porous materials (painted metals, anodized aluminum, mill finished aluminum, PVC, glass, and similar materials unless specifically specified as part of the work under other Specification Sections:</td>
<td>SE or P1</td>
</tr>
<tr>
<td>d. Masonry to items which penetrate exterior masonry walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items unless specifically specified as part of the work under other Specification Sections:</td>
<td>P1</td>
</tr>
</tbody>
</table>

3. Exterior Metal:
<table>
<thead>
<tr>
<th>Joint Condition</th>
<th>SEALANT TYPE</th>
</tr>
</thead>
</table>

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a. Metal to metal: P1 or SE
b. Metal to glass: SE

D. Interior joints (Listed by primary building material abutting sealant joints):

1. Interior Masonry:
   Joint Condition SEALANT TYPE
   a. Masonry to Gypsum board: SC
   b. Masonry to all items which penetrate exterior walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:

2. Gypsum Board:
   Joint Condition SEALANT TYPE
   a. Gypsum board to metal or wood trim: AP
   b. Gypsum board to abutting surfaces at exposed tops AA and bottoms partitions and walls:
   c. Gypsum board to door frames, window frames, AP penetrating conduits and piping, light-fixtures, electrical cover plates, building specialty items, ductwork, grilles, supply diffusers, faucets, piping, escutcheon plates and similar items:
   d. Gypsum board to plumbing fixtures: SM

3. Interior metal:
   Joint Condition SEALANT TYPE
   a. Metal to metal: SC
   b. Bedding of metal thresholds: B

4. Acoustical ceilings:
   Joint Condition SEALANT TYPE
   a. Acoustical ceiling edge angle to irregular wall surface AP

5. Tile:
   Joint Condition SEALANT TYPE
   a. Tile to tile vertical, and horizontal non-traffic joints: SM
   b. Tile to tile, horizontal pedestrian traffic joints: HL2

END OF SECTION

***
SECTION 08 11 13
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish and install the following:
   1. Non-labeled interior and exterior steel doors, complete with internal reinforcing, hardware cut-outs; and provided with louver and glazed openings, where so indicated.
   2. Hollow metal frames for doors, non-labeled and labeled, complete with internal reinforcing.
   3. Labeled and non-Labeled Hollow metal frames for fixed-glazed window conditions or "borrowed lights", complete with internal reinforcing.
   4. Metal glazing beads, loosely attached to hollow metal frames and doors, where so indicated, for removal and permanent installation during glazing operations.
   5. Hot dip galvanizing of all exterior metal doors and frames.
   6. Preparation required in doors and frames to receive electrified hardware.

1.3 RELATED SECTIONS

A. Section 04 20 00 – UNIT MASONRY ASSEMBLIES: for installation of hollow metal door frame anchors and grouting of frames in masonry construction.

B. Section 06 10 00 - ROUGH CARPENTRY: for wood blocking and nailers for anchoring metal frames where required.

C. Section 07 90 00 - JOINT SEALERS: for sealing around metal frames.

D. Section 08 14 16 - FLUSH WOOD DOORS: for wood doors to be installed in hollow metal frames.

E. Section 08 71 00 – FINISH HARDWARE: for finish door hardware and templates.
   1. Furnishing templates for hardware cut-outs and reinforcing.
   2. Furnishing and installing finish door hardware, and electrical door hardware.

F. Section 08 81 00 – GLASS & GLAZING: Furnishing and installing glass located in doors and frames.

G. Section 09 91 00 - PAINTING: for field-applied finish coatings.

H. Building-in of frame anchors to wall and partition construction: By trade responsible for wall and partition erection.
1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS & DEFINITIONS.

2. ANSI/SDI 100 - Standard Steel Doors and Frames.
4. ASTM A 568 - Steel, Carbon and High Strength Low Alloy Hot Rolled Strip, and Cold Rolled Sheet.
5. ASTM A 525 - Steel Sheet, Zinc-Coated by the Hot-Dip Process.
6. ASTM A 526 - Steel Sheet, Zinc Coated (galvanized) by the Hot Dip process, Commercial Quality.
7. All applicable federal, state and municipal codes, laws and regulations for exits.


1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, for doors, frames and shop applied finishes.
2. Certification: Manufacturer's written certification stating that doors, frames, and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section; that specified galvanized and shop priming has been performed; and that all U.L. fire-resistive requirements for the indicated Labels have been met.
3. Shop drawings: A complete schedule of doors and frames, to be furnished hereunder, coordinated with the door and frame schedule contained in the Contract Drawings indicating required fire ratings. Large scale details of each type door and frame construction, indicating all gages, cut-outs for glazing in doors, reinforcing, and anchorage.

1.6 REGULATORY REQUIREMENTS

A. Fire rated door construction shall conform to UL publication 10B.

B. Install fire rated door assemblies in compliance with NFPA 80.

1.7 QUALITY ASSURANCE

A. Source: Provide steel doors and frames by a single manufacturer for the entire project.

B. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by Hardware supplier, reviewed by the Contractor and approved by the Architect.
1.8 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing doors and frames. Coordinate wiring requirements for electrical door hardware.

B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.

C. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and accepted by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Prior to shipping, identify each frame and door with a removable metal or plastic label which corresponds with door schedule identifying opening number and location.

B. Deliver doors and frames boxed or crated to provide protection during transit and job storage.

C. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.

D. Store doors and frames at the building site upright and under cover. Place the units on wood dunnage and cover in a manner that will prevent rust and damage.

1.10 WARRANTY

A. Warrant steel doors and frames for minimum two years against defects in materials and workmanship commencing from the date of Substantial Completion. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehanging as required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. Amweld Building Products, Inc., Garrettsville OH.
   2. Ceco Company, Oakbrook Terrace IL.
   3. Curries Company / Essex Industries, Mason City IA.
   4. Steelcraft, an Ingersoll Rand Company
   5. Republic Builders Products Corporation, McKenzie TN.

2.2 DOORS

A. General: Refer to the Drawings and door schedule for design of doors, sizes, glazing cutouts in doors, and details.

B. Construction: Full flush commercial type, 1-3/4 inch thick (44.4 mm), unless noted otherwise herein or on the Drawings, meeting or exceeding the materials, gages, construction, and testing requirements of the referenced ANSI and SDI publications.
C. Interior Doors: ANSI 250.8, Level 2, Model 1 (Full Flush), ANSI A250.4 Physical Performance Level B, (Heavy Duty) having 18-gage, 0.053 inch thick (1.3 mm) steel faces, with a minimum STC rating of 32. Cores for interior doors shall be Polystyrene.

D. Exterior Doors: ANSI 250.8, Level 3, Model 2 (Seamless), ANSI A250.4 Physical Performance Level B, (Extra Heavy Duty) having 16-gage, 0.053 inch thick (1.3 mm) galvanized steel faces, with a minimum R factor of 14. Cores for interior doors shall be Polyurethane.

E. Glazing stops: Rectangular channel sections, not less than 20 gage; pre-drilled and loosely attached within the glazing cut-outs with countersunk tamper-resistant stainless steel screws; sized to properly accommodate the designated thicknesses of glass and glazing materials; and external edges set flush with, or slightly behind, door face. Modify glazing stops for UL Label doors to conform with UL fire rating requirements.

F. Hardware reinforcing: Welded in place steel reinforcement, hot rolled pickled and oiled steel per ASTM A569, with the following minimum gages:
   1. Hinges, 8 gage.
   2. Kick plates, 18 gage.
   3. Closers, locks, and all other hardware: 10 gage.
   4. Locations for reinforcing shall be determined from information and templates provided under Section 08710 - Hardware.

G. Fabrication
   1. Fabricate doors with hardware reinforcement welded in place.
   2. Attach fire rated label to each door unit.
   3. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
   4. Fabricate doors to permit concealed wiring for electrical door hardware.

2.3 HOLLOW METAL FRAMES

A. General: Refer to the Drawings for various types of frames, sizes, and profiles, UL fireresistive Label frames, and other characteristics of frames and related items.
   1. Frame type: Shop welded frames with mitered joints arc-welded, reinforced and ground smooth.

B. Materials for frames, reinforcement, anchors, anchor clips and related items: commercial grade cold-rolled steel conforming to ASTM A366 or commercial grade hot-rolled and pickled steel conforming to ASTM A569.
   1. Frame gage:
      a. Interior frames: 16-gage, 0.053 inch thick (1.3 mm), except as otherwise required for specific U.L. Label.
      b. Exterior frames: 14-gage, 0.067 inch thick (1.7 mm), with a zinc coating supplied by the hot-dip process conforming to ASTM A525 or A526, A60 or G60) coating weight standard. Exterior frames shall be thermally broken.
   2. Hinge, lock and strike reinforcement: 3/16 inch thick.
   3. Door closer reinforcement: 12 gage.
   4. Floor clips: 3/16 inch thick.
   5. Splice plates or channels: same gage as door frame.
7. Mortar guards: 26 gage.
8. Hinge reinforcement: 10 ga.

C. Frame construction:
1. Shop-fabricate frames as whole single units per door opening, except when frame size is too large to ship as a single unit. Oversized frames may be shipped in large sections as practicable for field assembly with concealed splice plates or channels.
2. Frame corner construction: As specified in paragraph A, above.
3. Reinforcements, stiffeners, and base angle clips: Welded to interior surfaces of frames to provide a stable base and so as to not interfere with installation of hardware.
4. Fabricate door frames to permit concealed wiring for electrical door hardware.
   a. Provide special preparation required for security door contacts including boxes welded to the frame to house door contact equipment and pre-drilling of the steel frame to receive the same. Coordinate all locations requiring special preparation for security door contacts with Electrical trades.
6. Provide mortar boxes, welded to frame, at back of hardware cut-outs where mortar or other materials may obstruct hardware operation.
7. Appearance of finished frames: Strong, rigid, completely free from warp and buckle, with miters well-formed and in true alignment, and with surfaces smooth and free from defects of any kind.
8. Silencer holes: Punch three holes in stop of strike jamb of door frames for application of silencers.
9. Glazing beads: Carefully place to properly accommodate the various thicknesses of glass and glazing materials, and loosely-attach to frames with flathead galvanized steel screws through pre-drilled holes having countersunk depressions.

D. Anchorage:
1. Anchor clips for frames in metal screw stud partitions: 12-gage steel z-shaped clips, 11/2 inch upturned and downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 09 29 00 - GYPSUM BOARD and Section 05 40 00 - COLD FORMED METAL FRAMING.
2. Anchor clips for frames in wood stud partitions: 18-gage steel with 3/4-inch high bendable straps, or equivalent type standard with the manufacturer, contained, for screw attachment to wood studs.
3. Anchors for frames in masonry walls: Adjustable, T-shaped, positively engaging the retainers on both flanges of each jamb member, when placed. The stem of the anchors shall be 2 inches wide by 12 gage, minimum, corrugated or perforated for mortar bond, and extend 10 inches into the masonry, unless otherwise indicated.
4. Provide not less than 4 anchors, clips, or bolts, per jamb, as applicable.

2.4 GLASS IN HM DOORS AND FRAMES
   A. Refer to Section 08 81 00 – GLASS AND GLAZING; for glass and glazing requirements.

2.5 FABRICATION TOLERANCES
   A. Maximum variation for doors and frames: maximum diagonal 1/16 inch measured with straight edge, corner to corner.
2.6 FACTORY FINISHING

A. Preparation: Pressure-sand all surfaces of all doors, frames, accessory items, anchors, and related items, to remove blemishes and foreign matter and provide paint grip. Spot-fill imperfections with metallic filler, and sand smooth. Thoroughly clean the surfaces by applying hot or cold phosphate treatment standard with the manufacturer.

B. Following cleaning apply one dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection. Bake, or oven dry, the primer at time and temperature recommended by the manufacturer for developing maximum hardness and resistance to abrasion.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine field conditions under which this work is to be performed. Notify Contractor in writing of conditions detrimental to proper completion of the work of this Section. Beginning work shall mean Installer accepts substrates and conditions.

3.02 INSTALLATION

A. Manufacturer's Instructions: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this Section. Comply with all referenced standards.

B. Frames: Where conditions allow, place frames prior to walls or ceilings. Accurately plumb, level, align, square and brace. Place frame anchors securely at three points near hinge locations on both jambs. Place anchors at both sides into floor.

1. Secure angle floor anchors with two, 3/8 in. tempered steel expansion bolts each. Set other anchors, except those built-in by other trades. Set exposed heads centered in holes and flush with frames.

2. Set heads of thru-type anchor bolts flush with frame.

C. Doors: Install doors utilizing hinges furnished by Section 08 71 00 - DOOR HARDWARE and hang doors accurately into frame openings with uniform tight clearances around jambs and head. Doors shall swing freely without binding or scraping and shall remain motionless at any location when released.

D. Glazing Stops: Install door louvers and glazing stops where scheduled or where indicated. Space fasteners not more than 8 in. o.c.

END OF SECTION

***
SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Solid-core doors with wood-veneer.
2. Fire rated and labeled wood doors.
3. Factory finishing for wood doors.
4. Factory fitting flush wood doors to frames and factory matching for hardware.
5. Glass lites for flush wood doors.

1.3 RELATED SECTIONS

A. Section 08 11 13 - STEEL DOORS AND FRAMES: for hollow metal frames scheduled to receive wood doors.

B. Section 08 71 00 - FINISH HARDWARE: for door finish hardware, and installation templates for hardware cut-outs.

C. Section 08 81 00 – GLASS & GLAZING: for glass and glazing occurring in flush wood doors.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 - "REFERENCE STANDARDS AND DEFINITIONS”.

2. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
   a. Chapter 9, Architectural Flush Doors.
4. All applicable federal, state and municipal codes, laws and regulations for exits.

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES.

1. Literature: Fabricator’s product data sheets, specifications, and performance data.
2. Certification: Fabricator’s written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
   a. Provide signed certification by agent of door manufacturer stating that machining, glazing and finishing of doors shall be performed by only by the manufacturer in its facilities.
3. Door schedule: All doors specified under this Section, coordinated with the schedule and details contained in the Contract Drawings.
4. Shop drawings: Elevations, and large scale sections and details of door construction, indicating profiles, joinery and cut-outs for hardware and glazing.
5. Samples:
   a. Corner section of specified flush type door, showing core construction and joinery.
   b. For transparent finishes: submit two 8-1/2 by 11 inch mounted finished samples of each specie of veneer specified.
   c. After receipt of color selections from the Architect, submit 12 by 12 inch pieces of tempered hardboard, coated with the actual pigmented prefinishing system to be used, in each selected color.

1.6 QUALITY ASSURANCE

A. All materials and workmanship shall conform in all respects to the specified grades of the Architectural Woodwork Institute (AWI) quality standards, except as modified herein.

1.7 REGULATORY REQUIREMENTS

A. Fire rated door construction shall conform to UL 10C.
B. Install doors in compliance with NFPA publication 80.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.9 DELIVERY, STORAGE AND HANDLING

A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content. Doors shall only be installed when HVAC system is operating and maintaining ambient temperature and
humidity conditions at occupancy levels and shall continue to operate for the remainder of the construction period.

B. Deliver wood doors in resilient non-staining moisture proof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.

C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.

D. Store doors in protected, elevated, dry areas; protect from exposure to sunlight and moisture. Seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.11 WARRANTY

A. Warrant solid core, interior doors for life of installation against warpage, delamination, and defects in materials and workmanship commencing from the date of Substantial Completion.

B. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehanging as required.

PART 2 - PRODUCTS

2.1 FLUSH FACED DOORS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. Weyerhaeuser Company, Architectural Door Division, Marshfield WI
   2. Eggers Industries, Architectural Door Division, Two Rivers WI.
   3. VT Industries Inc., Holstein IA.

B. General requirements: Conform to the requirements set forth in the designated Sections of the Architectural Woodwork Institute Quality Standards, and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, glazing cut-outs in doors, and other characteristics of doors to be furnished hereunder.

2.2 FIRE-RESISTANCE RATED “B” AND “C” LABEL DOORS

   A. General Construction: AWI Quality Standard, Section 1300, Type FD

   1. Door thickness: 1-3/4 inches, unless indicated otherwise.

   B. Models: Comply with the following AWI Quality Standard construction:

   1. 90 minute “B” label doors: Type “FD-1-1/2”.
   2. 60 minute label doors: Type “FD 1”.

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3. 45 minute “C” label doors: Type “FD 3/4”.

C. Door facing:
   1. Grade: AWI Premium, with AWI Grade AA faces
   2. Species and Cut: Clear Plain Sliced Red Oak
   3. Use Whole Face single sheet veneers with no veneer splicing.
   4. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   5. Transom Match: Continuous match.
   6. Stiles: Same species as faces.
   7. Cross-Banding: 1/8 in. high density fiberboard, urea formaldehyde free.

D. Core construction:
   1. Core: Non-combustible mineral sections.
   2. Top and bottom rails: Red Oak in order to produce a smooth surface after finish has been applied.
   3. Blocking:
      a. For doors scheduled to receive screw-mounted surface closers, provide adequate top rail blocking.
      b. Provide lock block for both mortise and cylindrical locks.
      c. For doors scheduled to receive surface mounted fire exit devices or vertical rods, provide top, intermediate and bottom rail blocking for screw mounting.

E. Adhesives: Type I per WDMA T.M.-6.

F. Accessories: For all fire-rated doors installed in pairs with both leaves active, provide 20-gage formed steel edges, without astragal, wrapped with veneer matching faces of doors.

G. Provide doors with a minimum STC rating of 40 where indicated on the door schedule.

2.3 NON-RATED SOLID-CORE DOORS

A. General Construction: AWI Quality Standard, Section 1300, Type Particleboard PC-5.
   1. Door thickness: 1-3/4 inches, unless indicated otherwise.

B. Door facing:
   1. Grade: AWI Premium, with AWI Grade AA faces
   3. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   4. Transom Match: Continuous match.
   5. Stiles: Same species as faces.

C. Core construction:
   1. Core: Particleboard complying with ANSI A208 Type 1, Grade 1-LD-2 having a density of 20 to 32 pounds per cubic foot.
2. Edge Bands: The stile edge bands shall be a 4-ply edge band laminated to the core on four (4) sides per AWI 1300-G-3 Spec. Symbol PC-5 with Type II highly water-resistant glue, using the high frequency method. Four-ply rails of milloption hardwoods shall be used. Outer ply for stiles shall be hardwood matching face veneers for species and color. Stiles and rails shall measure a minimum of 1 inches after trimming.

3. Top and bottom rails: Maple in order to produce a smooth surface after finish has been applied.

D. Adhesives: Type I per WDMA T.M.-6.
E. Provide doors with a minimum STC rating of 30 where indicated on the door schedule.
F. Provide doors with a minimum STC rating of 40 where indicated on the door schedule.

2.4 GLAZING BEADS
A. Glazing beads for non-fire rated doors:
   1. VT Industries VT4.
   2. Eggers style number 100, 5/8 inch sight line.
   3. Weyerhaeuser style number W-6.

2.5 FABRICATION
A. Fabricate doors in accordance with specified manufacturer’s requirements. Fabricated rated doors in compliance with WHI, or UL requirements as appropriate.

B. Laminate door facing, cross banding and assembled core in a hot press.

C. Bond stiles and rails to cores, sand for uniform thickness. Factory sand assembled door leaf.

D. Factory-machine doors to receive hardware from templates furnished under Section 08 71 00 – “Finish Hardware”. Do not machine for surface hardware. E. Factory cut light openings as scheduled.

F. Provide inner blocks at lock edge and top of door for closer hardware reinforcement.

G. Bottom rails of doors scheduled to be undercut shall be three inches thick; thickness of all other edges may be standard of manufacturer.

H. Fabrication tolerances: Maximum diagonal distortion (warp): 1/4 inch (6 mm) measured with straight edge from corner to corner over a maximum 42 by 84 inch surface area.

2.6 FACTORY FINISHING
A. Transparent finish: AWI Premium Grade Factory Finish System No TR-6, “Conversion Polyurethane” system, having a Satin sheen of 30° to 50° gloss units per ASTM D523. Finish system shall not substantially increase flame spread.
2. All wood doors shall be factory finished on all sides and edges.

2.7 GLAZING SYSTEMS
   A. Glazing: Provide factory installed glass products in accordance with the requirements in Section 08 81 00 – “Glass and Glazing”.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine locations to receive doors. Notify Construction Manager of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.
   B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.
   C. Ensure frames are plumb, level, square, and within tolerance.

3.2 DELIVERY AND STORAGE
   A. Deliver wood doors to Project site. Protect during shipment to prevent damage in manufacturer's standard plastic wrappings. Store in interior areas fully protected from moisture and damage.

3.3 PREPARATION
   A. Condition doors to ambient temperature and humidity at points of installation before hanging.

3.4 PREFITTING AND PREPARATION FOR HARDWARE
   A. Prefit and premachine wood doors at factory.
   B. Comply with tolerance requirements of AWI Quality Standards for prefitting. Machine doors for hardware requiring cutting of doors with templates provided under Section 08 71 00 – “Finish Hardware”. Comply with final hardware schedules and door frame submittals and other information required to ensure proper fit of doors and hardware.
   C. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in factory.

1. Non-rated doors: Except as indicated otherwise on Drawings, provide clearances of 1/8 in. at jambs and heads; 1/16 in. per leaf at meeting stiles for pairs of doors; and 1/8 in. from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 in. clearance from bottom of door to top of threshold.
2. For fire-rated doors, provide clearances complying with NFPA 80.
3. Bevel non-rated doors 1/8 in. in 2 in. at lock and hinge edges.
4. Bevel fire-rated doors 1/8 in. in 2 in. in lock edge; trim stiles and rails only to extent permitted by labeling agency.
D. Metal Astragals: Premachine astragals and formed steel edges for hardware where required for pairs of fire-rated doors.

3.5 INSTALLATION

A. Installations shall conform to approved submittals, including manufacturer's published instructions, to AWI Quality Standards, and to NWWD A Ref. 1 recommendations. Fire door installation shall conform to NFPA 80.

B. Hang doors plumb and true. Apply door hardware so that opening and closing movement of doors is smooth and free.

3.6 ADJUSTMENT AND CLEANING

A. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving doors and frames undamaged and in complete and proper operating conditions, in coordination with work of Section 08 71 00 – “Finish Hardware”.

3.8 CLEAN-UP

A. Remove cartons and debris as work progresses and leave work areas in broom clean conditions at completion of work of this Section.

3.9 COMPLETION

A. Before completion of work of this Section inspect work in company of Architect. Make adjustments and corrections to work leaving operating parts in perfect operating condition, jointing to adjacent material tight, surfaces without blemishes or stains, work properly executed and complete, and defects and damaged work replaced or corrected.

B. Re-hang or replace doors that cannot be made to operate properly, as directed by Architect.

END OF SECTION
***
SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section "Hollow Metal Doors and Frames".
2. Division 08 Section "Flush Wood Doors".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL 305 - Panic Hardware.
1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual overhead door closer bodies.
1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” heavy weight or as specified.
   b. Sizes from 3’1” to 4’0”: 5” heavy weight.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
a. Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.

4. Hinge Options: Comply with the following:
   
a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all outswinging lockable doors.

5. Manufacturers:
   
a. Hager Companies (HA).
   b. Bommer.
   c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
   
1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:
   
a. Door Controls International (DC).
   b. Trimco.
   c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, holdopen lever and inactive-leaf release trigger. Model as indicated in hardware sets.
   
1. Manufacturers:
   
a. Door Controls International (DC).
   b. Trimco.
   c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
   
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.

4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:
   a. Hiawatha.
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as those existing for the building.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU).
      b. Sargent Manufacturing (SA).
      c. Schlage (SC).

C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
   1. Threaded mortise cylinders with rings and cams to suit hardware application.
   2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
   4. Tubular deadlocks and other auxiliary locks.
   5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

D. Removable Cores: Provide removable cores as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

E. Keying System: Each type of lock and cylinders to be purchased through Vulcan Lock.
   1. Supplier shall conduct a “Keying Conference” to define and document keying system instructions and requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
   3. Existing System: Field verify and key cylinders to match Owner's existing system.

Key Quantity: Provide the following minimum number of keys:
GRANBY MEMORIAL HIGH SCHOOL RENOVATIONS  
GRANBY, CT

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

G. Construction Keying: Provide construction master keyed cylinders.


I. Key Registration List (Bitting List):
   1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
   2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handling without disassembly of the lock body.

   1. Where specified, provide status indicators with highly reflective color and wording for "locked/unlocked" or "vacant/occupied" with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1" x 0.6" with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.

   2. Manufacturers:
      a. Corbin Russwin Hardware (RU) - ML2000 Series.
      b. Sargent Manufacturing (SA) - 8200 Series.
      c. Schlage (SC) - L9000 Series.

B. Knurling: Where required by local code provide knurling or abrasive coating to all levers on doors leading to hazardous areas such as mechanical rooms, boiler and furnace rooms, janitor closets, and as otherwise required or specified.

2.9 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - DL4000 Series.
b. Sargent Manufacturing (SA) - 4870 Series.
c. Schlage (SC) - L460 Series.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
4. Short-lipped strikes: For locks at double doors.

B. Standards: Comply with the following:

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 MULTI-POINT LOCKSETS

A. Refer to hardware set for function and design intent.

1. Manufacturers:
   a. Corbin Russwin Hardware (RU).
   b. Sargent Manufacturing (SA).
   c. Schlage (SC).

2.13 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with key cylinder dogging device to hold the pushbar and latch in a retracted position. Omit cylinder dogging at exit-only doors and doors with security intruder function.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.


10. Extended cycle test: Devices to have been cycle tested to 9 million cycles.

11. Rail Sizing: Provide exit device rails factory sized for proper door width application.

12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
      b. Sargent Manufacturing (SA) - 80 Series.
      c. Von Duprin (VD) - 35A/98 XP Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable iron top and bottom retainers and a primed paint finish.

   1. Provide keyed removable feature where specified in the Hardware Sets.
   2. Provide stabilizers and mounting brackets as required.
   3. Provide electrical quick connection wiring options as specified in the hardware sets.
4. Manufacturers:
   
a. Same as exit device manufacturer.

2.15 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:
   
a. Corbin Russwin Hardware (RU) - DC6000 Series.
   b. Norton (NO) – 7500 Series.
   c. Sargent Manufacturing (SA) - 351 Series.

2.18 ARCHITECTURAL TRIM

A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer’s designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
   a. Hiawatha.
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.19 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
   a. Hiawatha.
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function. Coordinate with aluminium door manufacturer and provide low-profile concealed stop where required.
1. Manufacturers:
   a. Rixson Door Controls (RF).
   b. Sargent Manufacturing (SA).
   c. Glynn Johnson.

2.20 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

   F. Manufacturers:

      1. National Guard Products (NG).
      2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.22 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.23 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. Provide a keyed cylinder/core for every lockable hardware item.

3. The supplier is responsible for handling and sizing all products.

4. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
B. Manufacturer's Abbreviations:

1. MK - McKinney
2. MR - Markar
3. PE - Pemko
4. RO - Rockwood
5. RU - Corbin Russwin
6. SU - Securitron
7. RF - Rixson
8. NO - Norton

### HARDWARE SETS

**Set: 1.0**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Manufacturer Abbreviation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Power Supply</td>
<td>AQL4-R8E1</td>
<td>SU</td>
<td></td>
</tr>
<tr>
<td>1 Card Reader</td>
<td>By Division 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description: Exterior HM Kitchen -104A RHR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Continuous Hinge</td>
<td>FM300 EL-CEPTx32D</td>
<td>MR</td>
<td></td>
</tr>
<tr>
<td>1 Fail Secure Lock</td>
<td>ML20906-SEC NSA M92</td>
<td>RU</td>
<td></td>
</tr>
<tr>
<td>1 Cylinder / Core</td>
<td>Keyed as directed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Surface Overhead Holder</td>
<td>9-X26</td>
<td>RF</td>
<td></td>
</tr>
<tr>
<td>1 Surface Closer (offset bracket)</td>
<td>DC6210 A13</td>
<td>RU</td>
<td></td>
</tr>
<tr>
<td>1 Armor Plate (Push Side)</td>
<td>K1050 34&quot; 4BE CSK</td>
<td>RO</td>
<td></td>
</tr>
<tr>
<td>1 Threshold (coord w/ details)</td>
<td>1716AK FHSL14SS</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Head &amp; Jamb Seal</td>
<td>2891AS</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Sweep</td>
<td>315CN</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>1 Door Wiring Harness</td>
<td>QC-Cxxx (hinge to device)</td>
<td>MK</td>
<td></td>
</tr>
<tr>
<td>1 Frame Wiring Harness</td>
<td>QC-CxxxP (hinge/strike to J-box)</td>
<td>MK</td>
<td></td>
</tr>
<tr>
<td>Position Switch (concealed)</td>
<td>By Division 28</td>
<td>SU</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Operation: Door is normally closed and locked. Valid card at reader unlocks outside lever for momentary access. Monitoring by door position switch. During a loss of power the door will default to secure. Free egress at all times. Lock status will not change when the fire detection/suppression systems are activated. Rotating inside lever will activate request to exit switch for appropriate monitor by EAC systems. Outside key override.
### Set: 2.0
Description: Kitchen Dry Storage 105A

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Set No.</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Continuous Hinge</td>
<td>FM300</td>
<td>630</td>
<td>MR</td>
</tr>
<tr>
<td>1 Classroom Lock</td>
<td>ML2055 NSA</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td>1 Cylinder / Core</td>
<td>Keyed as directed</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>1 Surface Overhead Holder</td>
<td>9-X26</td>
<td>630</td>
<td>RF</td>
</tr>
<tr>
<td>1 Surface Closer</td>
<td>DC6200 Series A3 or A10</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td>1 Armor Plate</td>
<td>K1050 34&quot; 4BE CSK</td>
<td>US32DRO</td>
<td></td>
</tr>
<tr>
<td>1 Sweep</td>
<td>18061CNB</td>
<td>608</td>
<td>PE</td>
</tr>
<tr>
<td>3 Silencer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Set: 3.0
Description: Cafeteria, Instrumental, Choral and VOC Tech Pairs
RHRA 101B, 107A, 113A, 117A

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Set No.</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hinge (heavy weight)</td>
<td>T4A3386 (qty, size, nrp per spec)</td>
<td>US32DMK</td>
<td></td>
</tr>
<tr>
<td>2 Exit Device (SVR,LBR,classrm,CD)</td>
<td>ED5470 N955ET M55 M52</td>
<td>630</td>
<td>RU</td>
</tr>
<tr>
<td>5 Cylinder / Core</td>
<td>Keyed as directed</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>2 Surface Closer</td>
<td>DC6200 Series A3 or A10</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td>2 Kick Plate</td>
<td>K1050 10&quot; 4BE CSK</td>
<td>US32DRO</td>
<td></td>
</tr>
<tr>
<td>2 Door Stop</td>
<td>404 wall; 441CU floor; or per spec</td>
<td>US26DRO</td>
<td></td>
</tr>
<tr>
<td>1 Head &amp; Jamb Seal</td>
<td>2891AS</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2 Z-Bracket (to suit seal size)</td>
<td>BKT050SP</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2 Astragal</td>
<td>303AS</td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td>2 Mortise Auto Door Bottom (Doors 107A, 113A and 117A)</td>
<td>434ARL ACP112BL</td>
<td>PE</td>
<td></td>
</tr>
</tbody>
</table>

### Set 4.0
Description: Storage; Pair RHA 112A

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Set No.</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hinge (heavy weight)</td>
<td>T4A3386 (qty, size, nrp per spec)</td>
<td>US32D MK</td>
<td></td>
</tr>
<tr>
<td>Dust Proof Strike</td>
<td>570</td>
<td>US26D</td>
<td></td>
</tr>
<tr>
<td>Flush Bolt Set (constant-latching)</td>
<td>2845; 2945</td>
<td>US26D</td>
<td></td>
</tr>
<tr>
<td>Classroom Lock</td>
<td>ML2055 NSA</td>
<td>626</td>
<td>RU</td>
</tr>
<tr>
<td>1 Cylinder / Core</td>
<td>Keyed as directed</td>
<td>626</td>
<td></td>
</tr>
<tr>
<td>1 Coordinator</td>
<td>1700</td>
<td>Black</td>
<td>RO</td>
</tr>
<tr>
<td>2 Floor Stops</td>
<td>441CU floor</td>
<td>US26D RO</td>
<td></td>
</tr>
<tr>
<td>2 Surface Closer</td>
<td>DC6200 Series A3 or A10</td>
<td>689</td>
<td>RU</td>
</tr>
<tr>
<td>2 Kick Plate</td>
<td>K1050 10&quot; 4BE CSK</td>
<td>US32D RO</td>
<td></td>
</tr>
<tr>
<td>2 Silencer</td>
<td>608</td>
<td>RO</td>
<td></td>
</tr>
</tbody>
</table>
SET 5.0

Description: Voc-Tech, Instrumental Single RHR 117B, LHR 113B

- 3 Hinge (heavy weight) T4A3386 (qty, size, nrp per spec) US32D MK
- 1 Security Classroom Lock ML2042 NSA V01 626 RU
- 2 Cylinder / Core Keyed as directed 626
- 1 Surface Closer DC6200 Series A3 or A10 689
- 1 Kick Plate K1050 10" 4BE CSK
- 1 Head and Jamb Seal 2891AS PE
- 1 Mortise Auto Door Bottom 434ARL ACP112BL PE

SET 6.0

Description: Choral, Practice Rooms, Single 107B & 109A LH, 110A RH

- 3 Hinge (heavy weight) T4A3386 (qty, size, nrp per spec) US32D MK
- 1 Classroom Lock ML2055 NSA 626 RU
- 1 Cylinder / Core Keyed as directed 626
- 1 Surface Closer DC6200 Series A3 or A10 689 RU
- 1 Kick Plate K1050 10" 4BE CSK US32D RO
- 1 Door Stop 404 wall; 441CU floor; or per spec US26D RO
- 1 Head & Jamb Seal 303AS PE
- 1 Mortise Auto Door Bottom 434ARL ACP112BL PE

SET 7.0

Description: Instrumental Storage, Offices, AV Storage, Single
114A LH, 120A RHR, 108A RH, 108B LH, 119A RHR

- 3 Hinge (heavy weight) T4A3386 (qty, size, nrp per spec) US32D MK
- 1 Entrance Lock ML2053 NSA 626 RU
- 1 Cylinder / Core Keyed as directed 626
- 1 Kick Plate K1050 10" 4BE CSK US32D RO
- 1 Door Stop 404 wall; 441CU floor; or per spec US26D RO
- 1 Head & Jamb Seal (adhesive) S442BL PE
## SET 8.0

**Description:** Culinary Arts, Single 118B RHR, LH 118A

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Catalog No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Hinge (heavy weight)</td>
<td>T4A3386</td>
<td>US32D MK</td>
</tr>
<tr>
<td>1</td>
<td>Security Classroom Lock</td>
<td>ML2042 NSA V01</td>
<td>626 RU</td>
</tr>
<tr>
<td>2</td>
<td>Cylinder / Core</td>
<td>Keyed as directed</td>
<td>626</td>
</tr>
<tr>
<td>1</td>
<td>Surface Closer</td>
<td>DC6200 Series A3 or A10</td>
<td>689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>K1050 10&quot; 4BE CSK</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Head and Jamb Seal</td>
<td>2891AS</td>
<td>PE</td>
</tr>
</tbody>
</table>

## Set: 9.0

**Description:** Toilet, Single 106A LH

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Catalog No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Hinge (heavy weight)</td>
<td>T4A3386</td>
<td>US32D MK</td>
</tr>
<tr>
<td>1</td>
<td>Staff Toilet Lock</td>
<td>ML2029 NSA V20</td>
<td>626 RU</td>
</tr>
<tr>
<td>1</td>
<td>Cylinder / Core</td>
<td>Keyed as directed</td>
<td>626</td>
</tr>
<tr>
<td>1</td>
<td>Surface Closer</td>
<td>DC6200 Series A3 or A10</td>
<td>689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>K1050 10&quot; 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1</td>
<td>Mop Plate</td>
<td>K1050 6&quot; 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1</td>
<td>Door Stop</td>
<td>404 wall; 441CU floor; or per spec</td>
<td>US26D RO</td>
</tr>
<tr>
<td>3</td>
<td>Silencer</td>
<td>608</td>
<td>RO</td>
</tr>
<tr>
<td>1</td>
<td>Coat Hook</td>
<td>RM823</td>
<td>US32D RO</td>
</tr>
</tbody>
</table>

## Set: 10.0

**Description:** Custodian; Single 115A LH

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item Description</th>
<th>Catalog No</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Hinge (heavy weight)</td>
<td>T4A3386</td>
<td>US32D MK</td>
</tr>
<tr>
<td>1</td>
<td>Storeroom Lock</td>
<td>ML2057 NSA</td>
<td>626 RU</td>
</tr>
<tr>
<td>1</td>
<td>Cylinder / Core</td>
<td>Keyed as directed</td>
<td>626</td>
</tr>
<tr>
<td>1</td>
<td>Surface Closer</td>
<td>DC6200 Series A3 or A10</td>
<td>689</td>
</tr>
<tr>
<td>1</td>
<td>Kick Plate</td>
<td>K1050 10&quot; 4BE CSK</td>
<td>US32D RO</td>
</tr>
<tr>
<td>1</td>
<td>Door Stop</td>
<td>404 wall; 441CU floor; or per spec</td>
<td>US26D RO</td>
</tr>
<tr>
<td>1</td>
<td>Head &amp; Jamb Seal (adhesive)</td>
<td>S442BL</td>
<td>PE</td>
</tr>
</tbody>
</table>

END OF SECTION

***
PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. This Section includes glass and glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Exterior hollow metal doors and fixed frames.
   2. Interior wood doors, fixed frames, and millwork.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
   1. Division 06 Section “Architectural Woodwork” for display case glazing.
   2. Division 08 Section “Hollow Metal Doors and Frames” for steel doors and fixed hollow metal framed openings receiving glass and glazing.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Division 01 Section "References". Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. ASTM C 1036 - Flat Glass.
   2. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

B. The following reference materials are hereby made a part of this Section by reference thereto:

1.5 SUBMITTALS

A. Submit the following under provisions of Division 01 Section "Submittal Procedures".
   1. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
   2. Warranty: Provide copies of manufacturers’ actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof
   3. Samples:
      a. 12 by 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
b. Glazing tape: 12 inch length of specified type and size.

1.6 QUALITY ASSURANCE

A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.

B. Installer: A firm with a minimum of three years experience in type of work required by this Section and which is acceptable to manufacturers of primary materials.

C. Glass Thickness: Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section. Provide units with proper thickness, edge clearance and tolerance to comply with recommendations of glass manufacturer.


1.7 EXAMINATION OF SITE AND DOCUMENTS

A. The bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Subcontractor's failure to familiarize themselves with the contractor documents or site conditions. By submitting a bid, the bidder agrees and warrants that he has had the opportunity to examine the site and the contract documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the contract documents are adequate and that he will produce the required results.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 50 deg F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and FGMA Manual.
   1. Protect materials from moisture, sunlight, excess heat, sparks and flame.
   2. Sequence deliveries to avoid delays, but minimize on-site storage.

1.10 WARRANTIES

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

B. Manufacturer's Special Project Warranty on Laminated Glass:
   1. Warranty Period: Manufacturer's standard but not less than 5 years after date of substantial completion.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS - GENERAL

A. General requirements for glass: Of domestic manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.

B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.
   1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping.

C. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.

2.3 GLASS

A. Tempered Float Glass GL-1; ASTM C 1048, Kind FT, Condition A, Type I, Class 1, tempered by the manufacturer's standard process (after cutting to final size). Use tempered safety glazing in doors and where glass extends to floor frame.
   1. Thickness: minimum of 1/4 inch.
   2. Manufacturers:
       4. Viracon, Owatonna MN.
       5. PPG Industries Inc, Glass Group, Pittsburgh PA.
       6. NSG Group, Toledo, OH.

2.4 GLAZING MATERIALS

A. Glazing Material: Silicone Rubber Glazing Sealant; silicone rubber one-part elastomeric sealant; FS TT-S-001543, Class A; acid-type for non-porous channel surfaces, and non-acid type where any of the channel surfaces are porous.
   1. Manufacturers and Products:
       a. “999-A” by Dow Corning.
       b. “Silglaze N2500” by General Electric.
       c. “Rhodorsil 3B” by Rhone-Poulenc.

B. Preformed Butyl Rubber Glazing Sealant; tape or ribbon (coiled on release paper) of polymerized butyl, or mixture of butyl and polyisobutylene, compounded with inert fillers and pigments, solvent-based with minimum 95 percent solids, thread or fabric reinforcement, tack-free within 24 hours, paintable, non-staining.

C. Molded Neoprene Glazing Gaskets; molded or extruded neoprene gaskets of the profile and hardness required for watertight construction; ASTM D 2000 designation 2BC 415 to 3BC 620.
D. Pure silicone caulk, closed cell PVC tape, or DAP 33 putty as recommended by Technical Glass Products to comply with U.L. Listing. Must be used for fire-rated glass to meet fire rated labeling requirements.

E. Colors: For exposed materials provide color as indicated or, if not indicated, as selected by the Director from the manufacturer's standard colors. For concealed materials, provide any of the manufacturer's standard colors.

F. Setting Blocks: Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used.

G. Spacers: Neoprene, 40-50 durometer hardness, with proven compatibility with glazing materials used.

H. Compressible Filler Rod: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with glazing materials used, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.

I. Cleaners, Primers and Sealers: Type recommended by glazing material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Inspect receiving surfaces and ensure that are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.

B. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.

C. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.

D. Perform glazing work in accordance with FGMA Glazing Manual SIGMA and LSGA standards for glazing and installations methods.

3.2 INSTALLATION

A. Each installation shall withstand normal temperature changes, applicable wind loading, and impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.

B. Install glass in accordance with the standards detailed in the "Glazing Manual" of the Glass Association of North America and the "Sealant Manual" of the Flat Glass Marketing Association except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.

C. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.

D. Install glazing materials in accordance with the manufacturer's printed instructions.
3.3 GLAZING

A. Install setting blocks of proper size at quarter points of sill rabbet. If required to keep in place set blocks in thin course of the heel-bead compound.

B. Provide spacers inside and out, and of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

C. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light sizes, thickness and type of glass, and complying with manufacturer's recommendations.

D. Do not cut, seam, nip, or abrade glass which is tempered, heat strengthened, or coated.

E. Force glazing materials into channel to eliminate voids and to ensure complete "wetting" or bond of glazing material to glass and channel surfaces.

F. Tool exposed surfaces of glazing sealants and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.

G. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

H. Gasket Glazing: Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in the glazing system.

3.4 CURE, PROTECTION AND CLEANING

A. Cure glazing materials in accordance with manufacturer's printed instructions and recommendations, to obtain high early bond strength, internal cohesive strength, and surface durability.

B. Mark glazed openings immediately upon installation of glass by attaching crossed streamers to framing. Do not apply markers of any type to surfaces of glass.

C. Replace glass included in the work which is broken, or otherwise damaged, from the time Work is started at the site until the date of physical completion.

D. Maintain glass in a reasonably clean condition during construction to protect from build-up of harmful construction contaminants.
   1. Clean and trim excess glazing material from the glass and stops or frames promptly after installation.

E. When directed, just before Substantial Completion, remove dirt and other foreign material and wash and polish glass included in the work on both sides.

END OF SECTION 08 81 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY
A. Furnish and install:
   1. Metal furring and framing where indicated on the Drawings, including cross bracing and knee bracing.
   2. Metal ceiling and soffit framing.
   3. Deflection track assemblies at tops of metal stud partitions.
      a. Provide fire-rated assemblies at fire-rated partitions.
      b. Provide non fire-rated assemblies at all other partitions.

1.3 RELATED SECTIONS
A. Section 05 40 00 COLD FORMED METAL FRAMING: Exterior wall, and floor framing.
B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
C. Section 07 21 00 - BUILDING INSULATION: Thermal and acoustical batt insulation.
D. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
E. Section 09 29 00 - GYPSUM BOARD: Gypsum board, applied over metal framing installed under this Section 09 29 00, including but not limited to: gypsum board, abuse resistant gypsum board, cement board and related trim components.
F. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling, including metal suspension system.
G. Division 23 - HVAC: framing for supply and return air registers openings.
H. Division 26 - ELECTRICAL: for independent hangers for suspended lighting fixtures.

1.4 REFERENCES
A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS & DEFINITIONS.
   1. ASTM C 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   2. ASTM C 645 - Non-Load Bearing Steel Studs, Runners, and Rigid Furring Channels for Screw Application of Gypsum Board.
   3. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
4. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard.
7. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum board.


1.5 SUBMITTALS
A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.6 QUALITY ASSURANCE
A. Applicator, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
B. Obtain products required for the Work of this Section from a single manufacturer.

1.7 REGULATORY REQUIREMENTS
A. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
B. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.

1.8 DELIVERY, STORAGE AND HANDLING
A. Store materials inside under cover and in manner to keep them dry, protected from weather, corrosion and damage from construction traffic and other causes.

1.9 SEQUENCING AND SCHEDULING
A. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - Gypsum Board to assure the steady progress of the Contract.
B. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Metal components and related items:
   b. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.
   c. Marino Industries Corp., South Plainfield NJ.
   d. National Gypsum Company, Gold Bond Products Division, Charlotte NC.
   e. Unimast Incorporated, Franklin Park IL.

B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 FRAMING MATERIALS


B. Studs: 'C-shaped' screw studs, hot-dip galvanized steel complying to ASTM C 645, 27 mils (22 gauge) minimum, of widths indicated on the Drawings and spaced 12" o.c for a maximum height of 13'-6", or other gauges as required under the specified standards to meet fire resistance ratings.

C. Runners for metal studs: 'U-shaped' hot-dip galvanized steel track conforming to ASTM C 645, of gage and width to match respective stud sizes, having 1-1/4 inch leg, provided at tops and bottoms of all studs and at heads of all openings in stud partitions.

D. Internal reinforcement for various stud conditions, and bracing as required: 10 gauge, minimum, galvanized steel.

E. Furnish cross bracing and knee bracing, as required to assure a completely rigid assembly on metal stud partitions and furred areas.

2.3 DEFLECTION TRACK ASSEMBLIES:

A. Non Fire-Rated Assemblies

1. Deflection Track: Manufacturer’s standard top runner with extended flanges designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs, and the following configuration.
a. Top runner with extended deep flanges that either have V-shaped offsets that compress; slots 1 inch o.c. that allow fasteners attached to studs through the slots; or 16 gage sliding clip assemblies attached to top track and clipped to stud

B. Fire-Rated Assemblies:
   1. Deflection and Firestop Track: Top runner designed to allow partition heads to expand and contract with movement of structure above while maintaining continuity of the assembly. Comply with requirements of ASTM C 645 except configuration, of thickness indicated for studs and width to accommodate depth of studs indicated with flanges offset to accommodate gypsum board thickness.
      a. Manufacturers: Fire Trak Corp., Kimball, MN (800) 398-7660, or approved equal, subject to compliance with requirements of this specification.
      b. Offset Configuration:
         1) “Shadowline” at balanced and unbalanced fire-rated assembly partitions.
         2) “Cavity Shadowline” at shaftwall and chase wall (double stud) partitions.
   2. Coordination: Verify with partition schedule on the Drawings to ensure proper depth of flange offsets at various partitions types.

2.4 CEILING AND SOFFIT MATERIALS

A. Carrying channels: where applicable, shall be 2 inches deep, 54 mils (16 gauge) cold-rolled channels, galvanized.

B. Support channels: where applicable, shall be 3/4 inches deep, 54 mils (16 gauge) cold-rolled channels, galvanized.

C. Furring Channels: where applicable, shall be 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 18 mils (25 gauge) hot-dip galvanized steel galvanized steel conforming to ASTM C 645.

D. Metal Studs used in ceiling framing: ‘C-shaped’ screw studs, hot-dip galvanized steel complying to ASTM C 645, 18 mils (25 gauge), of widths indicated on the Drawings, or other gauges as required under the specified standards to meet fire resistance ratings.

2.5 ACCESSORIES

A. Fasteners:
   1. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
   2. Concrete stub nails for securing runners to concrete
   3. Nº.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.

B. Asphalt felt moisture barrier: ASTM D226, No. 15 asphalt saturated roofing felt.

C. Reinforcing plates for blocking: 33 mils (20 gauge) cold rolled sheet steel, provide minimum 6 inch width, or as otherwise indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION, QUALITY STANDARDS

A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 206, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.

B. Wherever fire-resistive rated assemblies are indicated on the Drawings, erect gypsum board systems in strict accordance with the manufacturers’ UL listed test constructions for the required fire rating on each specific assembly.
3.2 INSTALLATION OF PARTITION FRAMING, GENERAL

A. Install metal runners at floor and ceiling to structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.

B. Install metal stud framing with open side facing in same direction, engaging floor and ceiling runners.

1. Stud spacing based upon stud sizes listed:
   a. Typical: 12 inches on centers.
   b. At cement board substrate for tile finishes: 12 inches on center.
   c. At partitions supporting wall cabinets and other wall mounted equipment: 12 inches on center.
   d. At curved partitions space framing closer together than normal to prevent flat areas between framing members.

2. When necessary to splice studs, nest stud with 8 inch overlap and screw studs together with screws on both flanges.

3. Where curved partitions occur, space framing closer together than normal to prevent flat areas between framing members.

4. Where studs are installed directly to exterior masonry walls, install asphalt felt between stud and wall.

C. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and other elements; screw fasten with screw through both flanges of studs and track, top and bottom.

D. Securely anchor studs to jamb and head anchors of steel door and window frames. Over head of frames and openings in partitions, install a horizontal section of runner with a web flange bent at each end, horizontally and secure to strut studs with two screws in each bent web. Provide cripple studs over wall openings.

E. Where horizontal studs are used for wall reinforcing or framing, cut pieces of stud and install horizontally between vertical studs. Cope horizontal studs to fit between flanges of vertical studs. Bend ends of horizontal studs or install clip angles in order to secure by screwing to vertical studs.

F. Furnish and install additional cross bracing and knee bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.

3.3 INSTALLATION OF DEFLECTION TRACK

A. Isolate interior metal stud framing and shaft wall framing from building structure to prevent transfer of loading imposed by structural movement due to deflection.

1. Install deflection track top runner in accordance with manufacturer’s instructions and as required to attain lateral support and avoid axial loading.

2. Install fire-rated deflection track top runner in accordance with manufacturer’s instructions at top of fire-rated, corridor and smoke partitions.

3.4 INSTALLATION OF REINFORCING PLATE BLOCKING

A. Install steel reinforcing plates in partitions and furred walls for the support of wall mounted objects as follows:
1. At wall mounted cabinets, marker boards, projections screens and wherever such reinforcing plates are indicated on the drawings or required for installation of items attached to the framing system.

2. In locations where wall bumpers are to be installed for the protection of wall surfaces from swinging doors. (See Section 08 71 00, FINISH HARDWARE).

B. Secure gauge sheet metal reinforcing plates to steel studs with 1-1/4", Type "S" bugle head screws.

3.5 INSTALLATION OF CEILING AND SOFFIT FRAMING

A. Install framing to height indicated, independent of walls, columns, and above ceiling work. Erect after Work above ceiling is complete. Coordinate the location of hangers with other work.

B. Securely anchor hangers to structural members or embed in structural slab. Space hangers to achieve deflection limits indicated.

C. Space main carrying channels at maximum 48 inch centers; not more than 4 inches from wall surfaces. Lap splice securely.

D. Securely fix furring channels or metal studs to hangers to prevent turning or twisting and to transmitted full load to hangers.
   1. Place furring channels perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls and rigidly secure. Lap splice securely.
   2. Screw fasten metal studs perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls. Lap splice securely.

E. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

3.6 TOLERANCES

A. Install partition and ceiling framing and furring with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

3.7 CLEANING

A. Daily clean work areas by sweeping and disposing of debris and scraps.

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish and install:
   1. Taped, compounded and sanded gypsum board finishes including all trims, metal ceiling coves, reglets, and accessory components.
   2. Shaftwall system, including framing, liner panels, and gypsum board finish components.
   3. Moisture resistant gypsum board.
   4. Cement board substrate for wall tile.
   5. Abuse resistant gypsum board

B. Install access panels occurring in gypsum board work furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED SECTIONS

A. Section 05 40 00 - COLD FORMED METAL FRAMING: Load bearing curtain wall framing.

B. Section 06 10 00 - ROUGH CARPENTRY:
   1. Supplemental wood framing and blocking supporting gypsum board.
   2. Installation of metal door frames in gypsum board work. C.

   Section 06 20 00 - FINISH CARPENTRY: Interior wood trim.

D. Section 07 21 00 - BUILDING INSULATION: Thermal and acoustical batt insulation.

E. Section 08 11 13 - STEEL DOORS AND FRAMES: Furnishing steel door frames occurring in drywall construction.

F. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in drywall ceilings, partitions and walls.

G. Section 09 22 00 - METAL SUPPORT ASSEMBLIES: Non-load bearing partition and ceiling framing and furring.

H. Section 09 30 13 – CERAMIC TILE: Ceramic tile finishes over cement board substrate.

I. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceilings.

J. Section 09 91 00 - PAINTING: Applied finish coatings.
K. **Section 10 44 00 – FIRE PROTECTION SPECIALTIES:** surface or recess mounted in drywall construction.

L. **Division 23 - HVAC:** Supply and return air registers.

M. **Division 26 - ELECTRICAL:** Independent hangers for suspended lighting fixtures.

### 1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS & DEFINITIONS. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM C 36 - Gypsum Wallboard.
2. ASTM C 442 - Gypsum Backing Board and Core Board.
5. ASTM C 630 - Water Resistant Gypsum Backing Board.
6. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
7. ASTM C 919 - Use of Sealants in Acoustical Applications.
8. ASTM C 1047 - Accessories for Gypsum wall board and veneer base.
9. ASTM D 3678 - Polyvinyl chloride material for indoor exposure.
10. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
13. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
14. ANSI A118.9 - Cementitious Backer Units.
15. GA 201 - Gypsum Board for Walls and Ceilings.
17. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
18. GA 220 - Recommended Specifications for Gypsum Board Winter Related Job Problems.
19. All applicable federal, state and municipal codes, laws and regulations for fire rated assemblies.


### 1.5 COORDINATION

A. Work of this Section shall be closely coordinated with the work of **Section 05 40 00 - COLD FORMED METAL FRAMING** and **Section 09 22 00 - METAL SUPPORT ASSEMBLIES**, to assure the steady progress of the Contract.

### 1.6 SYSTEM DESCRIPTION
A. The Drawings make no distinction between gypsum board products. All board materials supplied under this Section are referred to in the Drawings as gypsum wallboard, “GWB” or such similar terminology. It is required as part of the Work of this Section to have the installer furnish and install the appropriate board materials and provide the correct wallboard finishes for the conditions described herein and shown on the Drawings.

1. Required board thickness are indicated on the Drawings and the locations where fire resistant construction is required.

1.7 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

2. Shop drawings: Details of any special conditions associated with fireproofing.

1.8 QUALITY ASSURANCE

A. Applicator, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.9 REGULATORY REQUIREMENTS

A. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.

B. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners’ insurance underwriters.

1.10 DELIVER, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1. Neatly stack board materials flat to prevent sagging.

C. Handle board materials so to prevent damage to edges, ends and surfaces.

D. Protect trim, accessories and corner beads from being bent or damaged.

1.11 ENVIRONMENTAL CONDITIONS

A. In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.

1.12 SEQUENCING AND SCHEDULING

A. Do not install gypsum board until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.
B. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:

1. Shaft wall system components:
   a. United States Gypsum Company, Chicago IL. (USG).
   b. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond).
   c. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.

2. Gypsum board products:
   a. United States Gypsum Company, Chicago IL. (USG).
   b. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond).
   c. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.

3. Abuse resistant gypsum board (ARGB):
   a. United States Gypsum Company, Chicago IL (USG).
   b. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond).
   c. Georgia Pacific Corporation, Gypsum Division, Atlanta, GA.

4. Cement board (tile substrate):
   a. Glasscrete Inc., Bakersfield, CA.
   b. WR Bonseal Inc., Charlotte, NC.
   c. United States Gypsum Company, Chicago, IL.

5. Polyvinyl chloride trim and accessories:
   b. Vinyl Corporation, Miami FL.
   c. Alabama Metal Industries Corporation, (AMICO) Birmingham, AL.

6. Reveal trim:
   a. Pittcon Industries, Inc., Riverdale MD.
   b. Fry Reglet Corporation, Norcross GA
   c. Gordon Inc., Shreveport LA.
   d. MM Systems Corporation, Tucker GA.

B. The design and details as shown on the Drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 BOARD MATERIALS

A. Gypsum Board:
   1. ASTM C1396 (Section 5), regular type [except where Type X fire-resistant type is indicated or required to meet UL assembly types].
   2. Edges: Tapered.
   3. Thickness: 5/8 inch, unless otherwise indicated.
a. Where curved gypsum board construction is indicated, use 1/4 inch thick flexible facing board.

4. Acceptable products:
   a. Typical partitions and ceilings: Equivalent to SHEETROCK brand regular, SW, FIRECODE or FIRECODE "C" Core gypsum panels as manufactured by USG, or equal.

   B. UL fire resistance rated, ASTM C 36 type “X” board, 5/8 inch thick, except where 1/2 inch thickness is indicated on Drawings, of lengths to minimize end joints, with tapered edges, equal to: USG Sheetrock brand “Firecode C-Core” or Gold Bond brand “Fireshield G, Enhanced Version”.

   C. Abuse resistant gypsum board (ARGB): Impact resistant UL type “FRX” fire resistance type, ASTM C-1278 board 5/8 inch thick with tapered edges and of lengths to minimize end joints. Board shall consist of an exposed face of gypsum and cellulose fibers, an unexposed face having glass fiber-mesh scrim embedded in gypsum and cellulose fibers, and a perlite core. Acceptable product and manufacturer: USG “Fiberock VHI” (Very-high Impact) Abuse-Resistant Gypsum Fiber Panels or approved equal.
   1. Performance properties:
      a. Surface abrasion: .284 inch, when tested in accordance with ASTM D4777 with 25 pound added weight, 30 abrasion cycles.
      b. Surface indentation: 0.11 inch, when tested in accordance with ASTM D5420 with 72 in-lb drop energy.
      c. Soft body impact, when tested in accordance with ASTM E695: 1) Surface failure: 180 ft-lb.
         2) Deformation failure: 240 ft-lb, with L/240 deflection.
      d. Penetration failure: More than 300 ft-lb.
      e. Hard body impact, when tested in accordance with swinging ram apparatus: 175 ft-lb.

   D. Moisture resistant gypsum board: Conforming to ASTM C 1396 and C 630, 5/8 inch thick, of lengths to minimize end joints, with tapered edges.

   E. Cement board, for use as substrate for ceramic tile: nominal 1/2 inch thickness manufactured for interior or exterior application, glass fiber reinforced, with a minimum compressive strength of 2,500 pounds per square inch and minimum flexural strength of 1,000 pounds per square inch.

   F. Exterior Gypsum ceiling and soffit board: Conforming to ASTM C-931, fire rated 5/8 inch thick, supplied in 48 inch widths, having tapered edges, equal to USG Sheetrock brand “Exterior Gypsum Sheathing Board,” or Gold Bond brand “Exterior Soffit Board”.

   G. Sag-resistant gypsum board ceiling panels: non-rated ½-inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges, conforming to ASTM C36, ASTM C1395 and ASTM C1396.

   H. Flexible Gypsum Board: ASTM C 1396/C 1396M, ¼-inch thick with tapered edges. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

2.3 SUSPENSION SYSTEM COMPONENTS
A. Tie Wire: ASTM A 641/A 641 M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency. a. Type: Post installed, expansion anchor.

C. Wire Hangers: ASTM A 641/A 641M, Class I zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.

E. Furring Channels (Furring Members): 0.0538-inch-bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

F. Grid Suspension System for Flat Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following: a. Armstrong World Industries, Inc.; Drywall Grid Systems. b. Chicago Metallic Corporation; Drywall Furring System. c. USG Corporation; Drywall Suspension System.

G. Grid Suspension System for Flat Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following: a. Armstrong World Industries, Inc.; Drywall Grid Systems. b. Chicago Metallic Corporation; Drywall Furring System. c. USG Corporation; Drywall Suspension System.

H. Grid Suspension System for Curved Ceilings: ASTM C 645, direct-hung system composed of factory-bent curved main beams and cross-furring members that interlock. Radius as indicated on drawings.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. USG Corporation; Drywall Suspension System.
      b. Armstrong World Industries, Inc.;
      c. Chicago Metallic Corporation; Drywall Furring System
   2. Wire Hanger: Where hanger wires for curved ceiling are exposed, use 1/32-inch stainless steel rope wire attached per USG’s Installation Guide: Exposed Hanger Solutions (IC453/rev 3-08).
2.4 SHAFT WALL COMPONENTS

A. Studs for shaft wall assemblies: USG steel C-H studs or Gold Bond I-Studs, 20 gage, galvanized and complying with ASTM C 645, 2-1/2 inch size, or as indicated otherwise in the drawings.

B. Runners for studs in shaft wall assemblies: USG steel J-Runner or Gold Bond J track, galvanized and complying with ASTM C 645, with 2-1/4 inch leg, in size and gage to match shaft wall studs.

C. Struts for jamb framing of door openings in shaft wall assemblies: J-type strut, galvanized and complying with ASTM C 645, 20 gauge, with minimum 3 inch return.

D. Shaftwall liner: UL fire resistance rated, ASTM C 442 - Type X board with beveled edges, 1 inch thick, 24 inches wide, of lengths to minimize end joints, equal to: USG Sheetrock Brand Gypsum Liner Panels or Gold Bond Fire-Shield Shaftliner.

E. Fire rated gypsum board: UL fire resistance rated, ASTM C 36 ‘Type X’ board, 1/2 inch thick, of lengths to minimize end joints, with tapered edges, equal to: USG Sheetrock brand ‘Firecode B-Core’ or Gold Bond brand ‘Fireshield G, Enhanced Version’.

2.5 ACCESSORIES

A. Paper faced trim accessories for use with Abuse Resistant Gypsum Board:
      a. Provide curved-edge corner bead with notched or flexible flanges at curved openings.
      a. LC-Bead (J-Bead): Use at exposed panel edges.
      b. L-Bead: Use where indicated
      c. U-Bead: Use where indicated.

B. Gypsum board polyvinyl chloride trim accessories, conforming to ASTM D 1784 and C 1047.
   1. J Bead: Edge trim with exposed 1/2 inch face cap, furnish trim model number corresponding to the board thickness where installed.
      b. Vinyl Corp. model number: JB58 (5/8 inch thick board).
      c. AMICO. model number: AMJB58 (5/8” thick board).
   2. L Bead: casing edge trim, furnish trim model number corresponding to the board thickness where installed
      a. Vinyltech model number: 221-58 (5/8 inch thick board).
      b. Vinyl Corp. model number: SB58 (5/8 inch thick board).
      c. AMICO. model number: AMSB58 (5/8 inch thick board).
   3. Corner beads, 90 degree with 1-1/4 inch flanges:
      a. Vinyltech model number: 209.
b. Vinyl Corp. model number: CB125.

c. AMICO. model number: AMCB125.

4. Control joints: “V” type joint with nominal 3/16 inch reveal and removable temporary tape:
   a. Gold bond model “EZ Strip Expansion Joint”.
   b. Vinyltech model number: 2027-16.
   c. Vinyl Corp. model number: CJV16.
   d. AMICO. model number: AMDCJV16.

C. Preformed aluminum edge trim, reglet, bullnose trim, radius trim, and miscellaneous shapes for gypsum partitions shall be equal to Softforms Commercial Grade Standard Extrusions, manufactured by Softforms Division, Pittcon Industries, Inc., or approved equal as manufactured by Fry Reglet, or Gordon Architectural Aluminum Specialties. Shapes shall be extruded 6063-T5 aluminum alloy 1/8 in. thick minimum (profile areas). Shapes shall be primed; plaster and paints shall be capable of bonding to primed surface. Fire rating shall be Class A. Provide all required shapes and radii indicated or required to complete the work.

D. Reveal trim: extruded aluminum trim with 1/2 inch wide recess by nominally 1/2 inch deep reveal channel with punched tapered fins. Provide outside corners, mitred intersections, and end caps as required for a complete installation.

E. Metal Ceiling Cove: shall be factory primed, roll-formed from .090” aluminum alloy single radius ceiling cove with concealed fasteners Model No. CC-1-TF (for tangential fin), CC-1PF (for perpendicular fin) as manufactured by Pittcon Industries, Riverdale, MD, or equal as approved by Architect.
   1. Rolled-formed to specific dimensions and tolerances and accurately formed to radii shown on Drawings.
   2. All hanging clips to be factory welded.
   3. Sections shall be fabricated in individual divided sections in single width units of 5’ where required and with joints provided for field finishable taping between sections.

F. Tapes and compound:
   1. Joint tape: Nominal 2 inch wide, high strength, cross-fibered paper drywall tape.
   2. Joint Compound for setting tape: ‘Speed-setting type compound’, field mixed equal to USG “Durabond 20” or Gold bond “Stay Smooth 30.”
   3. Joint Compound for finishing: field mixed joint compound equal to USG “Durabond 90” and Gold bond “Stay Smooth 90”, or factory pre-mixed compound equal to USG “Ready-Mixed Joint Compound” and Gold Bond “All Purpose Compound”.

G. Fasteners:
   1. Type S, bugle head screws complying with ASTM C 646, for applying gypsum board to metal framing, ceiling grid system, and furring channels. a. 1 inch long for single layer gypsum board.
   b. 1-5/8 inches long for double-layer gypsum board.
   2. Ceiling buttons, perforated type, 1 inch diameter, for use at multiple layered gypsum board ceiling systems.
H. Laminating adhesive: USG Durabond Joint Compound 90, USG Ready-mixed All Purpose Compound, or equal.

I. Acoustical Joint Sealer: One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
   1. Tremco, Beachwood OH.; product, “Acoustical Sealant”.
   2. United States Gypsum Company, Chicago IL.; product “USG Acoustical Sealant”.
   3. Pecora Corporation, Harleysville PA.; product “AC-20 FTR”.

J. Liquid sealer for cuts, holes and ends of moisture resistant board; provide one of the following or acceptable equal.
   1. Shellac type sealer: mix 4 pounds of orange or bleached shellac dissolved in 1 gallon of denatured ethyl-alcohol.

2.6 SOURCE QUALITY CONTROL

A. Obtain gypsum board and shaft wall products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.

B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.

C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

A. During the operation of gypsum board work, protect all wood, metal, glass, flooring, and other finished materials against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 INSTALLATION - GENERAL

A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 216,GA 220, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.

B. Where fire-resistive rated assemblies are indicated, erect gypsum board systems in strict accordance with the manufacturers’ UL listed test constructions for the required fire rating on each specific assembly.

C. Install specified control joints where indicated on Drawings and where run of partitions, or furred surfaces exceeds 30 feet. Show locations of all control joints on shop drawings.
   1. Locate control joints at corners of head frames of doors.
   2. Run vertical control joints continuously to top of partition, shaft wall or furred area, as applicable.

3.4 INSTALLATION OF SHAFT WALL
A. General: Install shaft wall system in strict accordance with manufacturer’s instructions to obtain the required fire rating.
   1. Box all openings and penetrations through shaft wall system partitions and ceilings ready to receive firestopping.

B. Installation of framing:
   1. Install J runners or E studs at floor and ceiling structural elements with suitable fasteners located 2 inches from each end. Space intermediate fasteners 24 inches on center.
      a. Install runners and studs prior to fireproofing.
      b. Do not splice studs, all studs shall extend from the floor to the underside of the structure above in one single length.
   2. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with one screw per flange.
      a. Where studs are installed directly to exterior masonry walls, install 15 pound asphalt felt between stud and wall.
   3. Install C-H studs 3/8 inch to not more than 1/2 inch less than opening height and install between liner panels with liner inserted in the groove. Install full-length steel Estuds over shaft wall liner at T-intersections, corners, columns and both sides of closure panels. Frame openings cut within a liner panel with E-studs around perimeter. For openings, frame with vertical E-studs at edges, horizontal J-strut at head and sill, and reinforcing as recommended by the shaft wall manufacturer. Suitably frame all openings to maintain structural support for wall.
   4. Furnish and install additional cross bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.

C. Walls surfaces:
   1. Liner boards: Cut liner board panels 1 inch less than opening height and erect vertically between J-runners. Where shaft walls exceed 14 feet in height, position liner panel end joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels.
   2. Erect 1/2 inch fire rated gypsum panel base layer horizontally on one side of studs with end joints staggered. Fasten base layer to studs with 1 inch, Type S-12 screws. Caulk perimeter of base layer panels.
   3. Apply 1/2 inch fire rated gypsum panels face layer vertically over base layer with joints staggered and attach with 1-5/8 inch Type S-12 screws staggered from those in base, spaced 12 inches on center, and driven into studs.

D. Horizontal ceiling installation, two hours:
   1. Install gypsum panels to horizontally installed CH or E studs.
   2. Install the base layer with edges parallel to the studs and attached with 1 inch Type S screws 24 inches on center
   3. Install face layer perpendicular to the studs and attach with 1-5/8 inch type S screws 12 inches on center
   4. Place face layer end joints between studs and secure with 1-1/2 inch Type G screws 12 inches on center

E. Finish face layer board materials as specified under the following Article.
3.5 INSTALLATION OF GYPSUM BOARD

A. Screw fasten only, gypsum board to framing and furring, with ends and edges occurring over firm bearing. At all door jambs screw fasten gypsum panels 8 inches on center to both box studs
   1. Erect single layer fire-resistance rated gypsum board vertically.
   2. Erect standard and moisture resistant layer board in most economical direction.
   3. Erect ceiling and soffit gypsum boards to meet UL requirements, where applicable, stagger end joints over supports. Secure gypsum board with fasteners inserted through ceiling buttons; anchor fasteners directly to framing or suspended support system.

B. Wherever items penetrate the gypsum board surfaces, use extra care in cutting the gypsum board to ensure a uniformly-dimensioned joint between the penetrating item and the gypsum board, and fill joints with specified sealant material. Verify the expected deflection factor of the penetrating members, and cut the gypsum accordingly, to prevent damage thereto from the deflecting members.

C. Treat cut edges and holes in moisture resistant gypsum board with approved liquid sealer.
   1. If shellac is used, apply in thin layers to dry quickly.

D. Install corner beads at all exterior corners of gypsum boards. Install casings (PVC trim) wherever gypsum board meets a dissimilar material, and in other locations indicated on the Drawings, except at floors where bottom of the board will be concealed by base, integral with flooring, resilient base, wood base or carpeted base.

3.6 INSTALLATION OF CEMENT BOARD

A. Wall framing substrate: Do not install cement board directly over protrusions from stud plane such as heavy brackets or fastener heads.

B. Make necessary cut-outs. Install cement board horizontally leaving 1/8 to 3/16 space at all joints, including joints with dissimilar materials. Stagger board joints with those of adjacent rows.

C. Fasten cement board with 1-1/4 inch length type S bugle head screw. Fasten boards every 8 inches on center in field and along edges. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.

D. At all joints and corners, fill gap solidly with dry-set or latex-modified, portland cement mortar and imbed 2 inch mesh fiberglass table and smooth material over joint and corner.

3.7 APPLICATION OF ACOUSTICAL SEALANT

A. Install sealant and backing in accordance with the requirements of Section 07900 - JOINT SEALERS and with the recommendations of ASTM C 919.

B. Seal all penetrations in partition types designated for “acoustical” insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.

C. Seal all partition perimeters prior to taping or compoundng. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
3.8 APPLICATION OF JOINT TREATMENT

A. Install joint tape at all joints where gypsum boards abut and where boards form internal corners, whether or not such joints will be concealed from view.

B. Apply compound to all joints, edges, corners, fastener head depressions and abrasions in the surfaces, whether or not such conditions will be concealed from view. Sand completely smooth all compound surfaces, which will be exposed to view, and leave ready to receive applied coatings or finish.

C. Provide the minimum levels of gypsum board finishes as defined by the Gypsum Association recommended specifications GA-214 and GA-216, per the following:
   1. At areas hidden from view, except as otherwise specified: Level 0.
   2. At areas hidden from view, requiring a fire rating: Level 1.
   3. At concealed plenum spaces above ceilings attic spaces: Level 1.
   4. At non-occupied spaces (i.e. attics): Level 1.
   5. At surfaces scheduled to be covered by wall paneling: Level 2.
   6. At surfaces scheduled to receive painted finishes with Level 4.

3.9 TOLERANCES

A. Maximum variation for gypsum board partitions and ceilings from true flatness: 1/8 inch per 10 feet, noncumulative.

3.10 CLEANING

A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.

B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of plaster, gypsum fill, and other materials installed under this Section.

END OF SECTION

***
SECTION 09 30 13
CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General Requirements, Refer to alternate's specification section that apply to the work of this Section.

1.2 SUMMARY
A. Furnish and install the following:
   1. Interior wall tile.
   2. Tile base and associated trim.
   3. Installation systems, waterproofing, adhesives, mortars and grouts.
B. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.3 RELATED SECTIONS
A. Section 03 30 04 – CAST-IN-PLACE CONCRETE: for concrete slab substrate.
B. Section 04 20 00 - UNIT MASONRY ASSEMBLIES: for concrete masonry unit substrate.
C. Section 06 10 00 - ROUGH CARPENTRY: for wood blocking.
D. Section 07 90 00 – JOINT SEALERS: for backer rod and sealant at tile control joints.
E. Section 08 31 00 - ACCESS DOORS AND PANELS and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
F. Section 09 29 00 – GYPSUM BOARD: for gypsum board substrate.
G. Section 10 28 13 - TOILET ACCESSORIES: for toilet accessories occurring in ceramic tile construction and installation templates.
H. Division 22 - PLUMBING: for floor drains occurring in tile construction.
I. Division 23 – MECHANICAL: Floor drains

1.4 REFERENCES
A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.
   1. ANSI A108.1A - Installation of Ceramic Tile in the Wet Set Method, with Portland Cement Mortar.
   2. ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
   3. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
   5. ANSI A118.4 - Latex-Portland Cement Mortar.
   6. ANSI A118.6 - Ceramic Tile Grouts.
7. ANSI A118.10 - Waterproofing.
9. ANSI A137.1 - Specifications for Ceramic Tile.
10. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
12. ASTM C 144 - Aggregate for Masonry Mortar.
15. ASTM C 920 - Specifications for Elastomeric Joint Sealant.


1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
   a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
   b. Provide confirmation and data that shows all flooring material and setting materials meet the testing and product requirements of The California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.

2. Selection samples:
   a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.

3. Verification samples:
   a. Mount tile and apply grout on one 24 by 24 inch cement backerboard board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
   b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
   c. Stone threshold, 12 inch long samples in shaped profile.

4. Grade Certificates: Manufacturer’s Master Grade Certificates submitted prior to shipment of tile to project.

5. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction.
Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

1. **Local/Regional Materials:**
   a. **Sourcing location(s):** Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
   b. **Manufacturing location(s):** Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. **Recycled content:** Manufacturers certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

3. **VOC Content:** Submit documentation showing VOC content for all materials submitted.

4. **Construction Waste Management.**

### 1.6 QUALITY ASSURANCE

A. Conform to ANSI/TCA A 137.1 and TCA Handbook for Ceramic Tile Installation.

B. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

C. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.

D. Installation materials: Materials must be compatible and from one source, single source responsibility for waterproofing, installation, Mortars and grouts. Job-site mixtures of sand Portland cement and site dilution of additives shall not be permitted.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

F. Mockups:
   1. Provide substrate preparation mockups in 10’x10’ size for Architect's review and approval. (See drawings for size and location)
   2. The contractor shall not proceed with installation until the required mockup has been approved by Architect.

### 1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.

B. Store and protect containers above floor level, keep dry until ready for use.

C. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy mortar and epoxy grouts at 70 degrees Fahrenheit (21degrees C) temperature for 24 hours prior to use.

### 1.8 ENVIRONMENTAL CONDITIONS

A. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.
B. Maintain ambient temperatures between 50 (10 degrees C) and 80 (26 degrees C) degrees Fahrenheit in tiled areas, during installation of mortar materials and for 7 days after completion.

   1. When temperature of substrate exceeds 90 (32 degrees C) degrees Fahrenheit, contact manufacturer for instructions.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.10 WARRANTY

A. Provide 2 year, non pro-rated warranty under provisions of Section 01 78 30 – WARRANTIES AND BONDS. Warranty shall provide for cracking, breakage or failure of tile due to defective workmanship.

   1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand Portland cement and site dilution of additives shall not be permitted.

B. Special Warranty: The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of 10 years. This special warranty extends the period of limitations contained in the General Conditions. Have the warranty countersigned by the installer and manufacturer.

C. The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written ten (25) year warranty against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.

   1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCA setting systems using specified setting and grout materials.

D. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer’s instructions and industry standard guidelines.

1.11 EXTRA MATERIALS

A. Upon completion of the Work of this Section, deliver to the Owner extra materials in an amount equal to 3 percent of tile and trim of each color, finish and type installed.

B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

   1. Ceramic wall tile:

      a. Daltile Corp, Dallas TX.

      b. American Olean Tile Company, Lansdale PA.

      c. United States Ceramic Tile Company, Sparta OH.
d. Crossville, Inc., Crossville TN.

2. Mortars, adhesives & Grouts:
   a. Laticrete International, Inc., Bethany CT.
   b. Mapei Corporation, Elk Grove IL.
   c. Bostik, Inc. Wauwatosa, WI.
   d. Ardex Americas, Aliquippa, PA.

3. Edging materials:
   c. Blanke International., Atlanta GA (800-787-5055)

2.2 TILE

A. Ceramic Wall Tile: Standard grade glazed ceramic tile, conforming to ANSI A137.1.
   1. Basis of design for 4-1/4 by 4-1/4 inches tiles:
   2. Basis of design for Base tiles:
      b. Trim shall include bull nosed internal and external corners and exposed edges and other shapes required to produce a finished installation.

B. Trim and special shapes: Provide all bases, caps, stops, returns, trimmers, and other shapes indicated or required to produce a finished installation.
   1. Except as may be otherwise indicated, provide color and finish matching adjacent field tile.

C. Preliminary color selection upon approval during construction, based on DalTile products, Color Wheel series. See Ceramic Tile Details sheet for patterns and colors.

2.3 STONE THRESHOLDS

A. Where indicated on the Drawings, provide marble thresholds complying with Class “A” of the Marble Institute of America, in color selected by the Architect from standard colors of the approved fabricator, shaped to provide a comfortable transition between tile and other floor finishes, with smooth matte surface finish and in the dimensions and thickness shown on the Drawings.

2.4 SETTING MATERIALS

A. General: Note that all setting materials “are intended to be “Low VOC” products complying with LEED Requirements and procedures must be 3rd Party Certified.

B. Trowelable Underlayment and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

C. Fluid applied anti-fracture membrane: Complying with German national standard (DIN18156, part 2), and STM C627 classification “Extra Heavy”. Two component liquid rubber membrane used with 20 mil thick flexible polyvinyl chloride sheeting reinforcing material. Acceptable products include:
   1. Waterproof membrane shall be resistant to urine, dilute acid, alkali, sugar, brine, and food waste products.
2. All materials shall be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured.

3. Waterproofing, crack suppression & anti-fracture membranes shall meet the following physical requirements:
   a. Water Permeability: (at 30ft.hydro/0.9 atmos/91.2kPa) Nil
   b. Elongation at break (ASTM D-751): 40%
   c. Service Temperatures: -20°C to +280°F (-28°C to +137°C)
   d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm²)
   e. Bond strength to concrete: 350psi (2.4MPa;24kg/cm²)
   f. Resistance to chemicals (90 day immersion):
      1) Brine solution Not Affected
      2) Sugar solution Not Affected
      3) Milk Not Affected
      4) 10% Acid Not Affected
      5) 10% Alkali Not Affected
      6) Toluol Softens
      7) Urine Not Affected
   g. Rubber solvents or keytones Not Recommended.
   h. Calcium chloride Excellent
   i. Aromatic solvents Not Recommended.
   j. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles
   k. Service Rating (TCA) Extra Heavy Duty

4. Acceptable products include:
   b. Laticrete product: “Laticrete 9235 Waterproofing” (non-solvent based) or Laticrete Hydroban waterproofing.

D. Thin-set polymer-modified Portland cement dry-set mortar for tile walls and floors: complying with the bond strength requirements of ANSI A118.4. Acceptable products include:
   2. Laticrete product: LATICRETE 254 Platinum Thinset Mortar or LATICRETE 333 Superflexible Admix gauge with LATICRETE 317 Thinset Mortar.

E. White thin-set mortar – 2 component, flexible, rapid – set, acrylic thin-set mortar system formulated for interior and exterior installations. Acceptable products include:
   1. Daltile product: Ultimate Bonding System – Rapid
   Laticrete product: White #254 Rapid Set

F. Medium-bed latex modified portland cement mortar Dry-set mortar for large size modular tile and dimensional stone: complying with the bond strength requirements of ANSI A118.4, compatible with color of tile. Acceptable products include:
   2. Laticrete product number 220 with number 333 additive or 255 Multimax.

2.5 GROUTING MATERIALS

A. Epoxy Grout: 100 percent solids, water cleanable, complying with ANSI A118.3 and ISO 13007 RG for floor applications. Color to be selected by Architect from manufacturer’s standard range.
1. Latapoxy SP-100 by Laticrete.
2. Kerapoxy by MAPEI.

B. Acrylic modified Portland cement (unsanded) grout conforming to ANSI 118.6. Acceptable products include:
   1. Mapei product: "Keracolor Wall" with acrylic latex additive "Plastijoints",
   2. Laticrete product “Laticrete Perma Color grout”

2.6 ELASTOMERIC SEALANT

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated. Comply with applicable requirements in Section 079200 - JOINT SEALANTS.
   1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Acceptable Products:
      a. Custom Building Products; 100 Silicone Caulk.
      b. Dow Corning Corporation; Dow Corning 786.
      c. GE Silicones; Sanitary 1700.
      d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
      e. Tremco, Inc.; Tremsil 600 White.

C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
   1. Acceptable Products:
      b. Tremco, Inc.; Vulkem 245.
      c. Pecora Corporation; NR-200 Urexpan.
      d. Tremco, Inc.; THC-900

D. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.7 EDGING MATERIALS

A. Pre-fabricated trim and profiles:
   1. Schluter “RONDEC”
      a. Open edges of wall tile.
      b. Expansion and control joints on wall.
      c. Outside corners
      d. Double-leg outside corners
   2. Schluter “JOLLY”
      a. Open edges of wall tile.
      b. Expansion and control joints on wall.
      c. Outside corners
d. Double-leg outside corners

3. Schluter “DILEX- HKU”
   a. Open edges of wall tile.
   b. Expansion and control joints on wall.
   c. Outside corners.
   d. Double-leg outside corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
   1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.
   2. Verify that required floor-mounted utilities are in correct location.
   3. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
   4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
   5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
   1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Vacuum clean substrate surfaces.

D. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

E. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION - GENERAL REQUIREMENTS

A. Installation Standards: The American National Standard Specifications for the Installation of Ceramic Tile, 2009 edition (ANSI A108), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in
referenced ANSI A108 standards, and as additionally specified below, and in accordance
with the manufacturer’s specifications of those products used.

B. TCA Installation Guidelines: TCA’s "Handbook for Ceramic Tile Installation." Comply with
TCA installation methods indicated in ceramic tile installation schedules.

C. Installation Methods: Schedule of substrate conditions, generic type of tile used, with
appropriate setting and grouting methods are listed at end of this Section.
   1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
   2. Back-butter tiles as required to provide coverage indicated.

D. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is
required, obtain the necessary information from the Architect. Do not interrupt tile pattern
around openings.

E. Tile Layout and installation
   1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile
      width.
   2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align
      base and wall joints.
   3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size.
      Make joints watertight, full without voids, cracks, excess mortar, or excess grout.
   4. Extend tile work into recesses and under or behind equipment and fixtures to form
      complete covering without interruptions, unless otherwise indicated. Terminate work
      neatly at obstructions, edges, and corners without disrupting pattern or joint
      alignments.
   5. Accurately form intersections and returns. Perform cutting and drilling of tile without
      marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-
      in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures,
      and other penetrations so plates, collars, or covers overlap tile.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control,
contraction, and isolation joints, where indicated during installation of setting materials,
mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements in Section 079200 -
      JOINT SEALANTS.

3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's
   written instructions to produce waterproof membrane of uniform thickness bonded securely
to substrate.

B. Install crack-suppression membrane to comply with manufacturer's written instructions to
   produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to
determine that it is watertight.

3.5 INSTALLATION OF CONTROL JOINTS

A. General: Provide control joints where indicated on the Drawings, and as directed by the
   Architect. Where not indicated, provide joints per the following:
   1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct
      sunlight or moisture.
2. Interior tilework: exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
4. At joint between wall and ceilings.
5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas, under SECTION 07900

B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.

C. Control joints:
   1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes, etc.
   2. Extend control joints full thickness of tile, setting bed and reinforcing.
   3. Keep open joints free of grout and debris until filled with sealant.

3.6 FLOORING INSTALLATION - CERAMIC TILE

A. General: Install in accordance with ANSI A108.5, and similar to TCA installation method number F122, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
   1. Setting materials:
   2. Grout materials: Acrylic modified Portland cement unsanded grout (ANSI A118.6).
   3. Grout materials: Epoxy grout

B. Install liquid applied waterproofing membrane with reinforcing as recommended by manufacturer over entire tile substrate area.

C. Install latex/portland cement mortar bed over cured waterproof membrane to a nominal thickness of 3/32 inch.

D. Grouting:
   1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
   2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.
   3. Epoxy Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

E. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.7 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Large Format Wall Tile Installation: Comply with tile manufacturer’s recommendations for setting beds and grouts.
   1. Substrate Tolerances: Do not exceed 1/8 in. in 10 ft. and 1/16 in. in 2 ft.

3.8 INSTALLATION - GROUT

A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.

C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.

D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.

E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.

F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.

G. Apply grout joint sealer in accordance with manufacturer’s instructions.

3.9 REPAIR

A. Replace cracked, chipped, broken, and otherwise defective tiles.

B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

3.10 CLEANING

A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tilework.
   1. Do not use acid or acid cleaners to clean tile.
   2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.11 CURING

A. Cover with clean non-staining 40 pound kraft paper. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.12 PROTECTION

A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

B. Protect tiled walls from impact, vibrations and heavy hammering on adjacent and opposite wall surfaces during installation of tile and for at least 14 calendar days after completion of installation.

END OF SECTION
***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SECTION INCLUDES

A. Furnish and install suspended acoustical tile ceiling including suspension system and associated edge moldings.

B. Furnish and install suspended linear metal ceilings including suspension system and associated trim.

1.3 RELATED SECTIONS

A. Section 09 22 00 - METAL SUPPORT ASSEMBLIES: Suspension system for suspended drywall construction ceilings and soffits.

B. Section 09 29 00 – GYPSUM BOARD: Soffit and wall construction adjacent to acoustical ceilings.

C. Division 21 – FIRE SUPPRESSION: for sprinkler heads in ceiling system.

D. Division 23 – HVAC: for Air diffusion devices in ceiling.

E. Division 26 - ELECTRICAL: Light fixtures and independent hangers for suspended fixtures.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM C 635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

2. ASTM C 636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.


4. ASTM E 1264 - Classification of Acoustical Ceiling Products.


B. The following reference materials are hereby made a part of this Section by reference thereto:

1. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.


1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

2. Shop drawings:
   a. 1/4 inch scale plans of each room or space; indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to the system.
   b. Large scale installation details of special conditions.
   c. All drawings bearing dimensions of actual measurements taken at the project.

3. Samples:
   a. 6 by 6 inch samples of acoustical units, illustrating material and finish.
   b. 12-inch long samples of suspension system components including main runners, cross runner and edge trim.

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturer’s certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

3. VOC Content: Submit documentation showing VOC content for all materials submitted.


1.6 QUALITY ASSURANCE

A. Applicator specializing in applying the work of this Section with a minimum of 3 years’ experience.

B. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 PROJECT CONDITIONS

A. Maintain uniform temperature of minimum of 60 degrees Fahrenheit and humidity of 20 to 40 percent prior to, during, and after installation.

ACOUSTICAL CEILING

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1.8 SEQUENCING AND SCHEDULING
A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, to allow work, which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.
B. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust-generating activities have terminated and overhead work is completed, tested and approved.
C. Install acoustical units after interior wet work is dry.
D. Coordinate work with elevator installer, to ensure acoustical ceiling is not installed until temporary service use of elevator by Contractor is no longer necessary and the elevator is ready for final inspection.

1.9 DELIVERY, STORAGE AND HANDLING
A. Deliver acoustical ceiling panel in original, unopened packages and store protected in a fully enclosed space.

1.10 WARRANTY
A. In addition to the specific guarantees requirements of the Section 01 78 30 – “Warranties and Bonds”, the Contractor shall obtain in the Owner’s name the standard written manufacture’s guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer’s published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities, which the Contractor may have by law or other provisions of the Contract Documents.

1.11 EXTRA MATERIALS
A. Provide to the Owner, extra ceiling panel and suspension components, 5 percent of each type installed.

1.12 EQUIPMENT
A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
   1. This Sub-Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the work of this section. All such items shall meet the approval of the Owner but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the “Manual of Accident Prevention in Construction” published by the Associated General Contractors (AGC) and the standards of the State Labor Department.

B. Staging, exterior and interior, required for the execution of the work of this section, shall be furnished, erected, relocated if necessary and removed by this Sub-Contractor. Staging shall be maintained in a safe condition without charge to and for the use of all trades as needed.
PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING PANELS

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:

1. USG Interiors Inc., Chicago IL.
3. CertainTeed Corp., Valley Forge, PA.
4. OWA USA, Munster, IN

B. ACT-1 Ceiling panel:

1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Panel size: 3/4" by 24" by 24" panels.
5. Edge Profile: Square Lay-in 15/16" for interface with USG DX/DXL 15/16" Exposed Tee grid.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.75.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
8. Flame Spread: ASTM E 1264; Class A (UL).
9. Light Reflectance White Panel: ASTM E 1477; 0.90
10. Dimensional Stability: ClimaPlus
11. Recycle Content: 69% - 85%
12. Acceptable products:
   a. Basis of design: USG Mars Climaplus Lay-In, 86185 as manufactured by USG Ceilings Plus; or approved equal by Armstrong or Certainteed or OWA USA.

C. ACT-2 Ceiling panel (kitchen):

1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Panel size: 5/8" by 24" by 24" panels.
5. Edge Profile: Square Lay-in 15/16" for interface with USG DX/DXL 15/16" Exposed Tee grid.
6. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
7. Flame Spread: ASTM E 1264; Class A (UL).
8. Light Reflectance White Panel: ASTM E 1477; 0.90
9. Dimensional Stability: ClimaPlus
10. Recycle Content: 24%
11. Acceptable products:
    a. Basis of design: USG Kitchen Lay-In, 3210 as manufactured by USG Ceilings Plus; or approved equal by Armstrong or Certainteed or OWA USA.
D. ACT-3 Ceiling panel (music room – alternate in a checkerboard pattern with ACT-1, as shown on the drawings):
   1. Surface Texture: Smooth
   2. Composition: Metal
   3. Color: White
   4. Panel size: 1 1/4" by 24" by 24" panels.
   5. Edge Profile: Square Lay-in 15/16" for interface with USG DX/DXL 15/16" Exposed Tee grid.
   6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.75.
   7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35.
   8. Flame Spread: ASTM E 1264; Class A (UL).
   9. Light Reflectance White Panel: ASTM E 1477; 0.90
   10. Dimensional Stability: ClimaPlus
   11. Recycle Content: 90%
   a. Basis of design: USG Geometrix 3-Dimensional Metal Panels, GF-1 as manufactured by USG Ceilings Plus; or approved equal by Armstrong or Certainteed.

2.2 SUSPENSION SYSTEM

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:
   1. USG Interiors Inc., Chicago IL.
   2. Armstrong World Industries, Inc., Lancaster PA
   3. CertainTeed Corp., Valley Forge, PA
   4. OWA USA, Munster, IN

B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
   1. Basis of design: USG Donn DX/DXL Series 15/16" Exposed tee grid; or approved equal by Armstrong or Certainteed or OWA USA.
   3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   5. Cap Material: Steel or aluminum cold-rolled sheet.
   6. Color: As selected by architect.
   7. Grid Face Width: As specified with ACT type.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
   1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.

E. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

F. Joint Sealer: One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
   1. Tremco, Beachwood OH; product, "Acoustical Sealant".
   2. United States Gypsum Company, Chicago IL; product “USG Acoustical Sealant”.
   3. Pecora Corporation, Harleysville PA; product “AC-20 FTR”.

2.3 METAL EDGE MOLDING AND TRIM

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:
   1. USG Interiors, Inc.: Compasso Elite
   3. CertainTeed Ceilings: Approved equal.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

C. Suspension Trim: Subject to compliance with requirements, provide one of the following:
   2. Color: As selected by Architect.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Beginning of installation means acceptance of site conditions.

C. Coordination: Coordinate and schedule installation of linear metal ceiling system with work of other trades affected by this installation, with particular attention given to mechanical and electrical work required to be installed and operating before ceiling work can begin.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.

B. Permit acoustical ceiling panel to reach room temperature and stabilized moisture content prior to installation.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Locate system on room axis, leaving equal sized border units of not less than one-half tile width.

C. Install all components of the suspended grid systems in accordance with the manufacturer's instructions, the approved shop drawings, conforming to ASTM C-636 requirements. Ensure a deflection not to exceed 1/360 span of 48-inch simple span.

D. Install specified edge moldings wherever ceilings intersect a wall or partition surface, and around all items having any dimension of 4 inches or more, which penetrate the ceilings. Set moldings absolutely level, using as long lengths as practicable, and secure with fasteners recommended by manufacturer for the type of substrate.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.

2. Screw-attach moldings to substrate at intervals not over 16' o.c. and not more than 3' from ends, leveling with ceiling suspension system to tolerance of 1/8' in 12'-0". Miter corners accurately and connect securely.

E. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

3. Install hanger wire to attachments with triple twists.
4. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

7. Do not attach hangers to steel deck tabs.

8. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

F. Install main tees parallel to the long dimension of each area, spacing the tees 48 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses.

G. Uniformly space the cross tees at 24 inches on centers, and secure the cross tees into the main tees as recommended by the system manufacturer.

H. Fit acoustical ceiling panel units in place, free from damaged edges or other defects detrimental to appearance and function. Install acoustical ceiling panel level, in uniform plane, and free from twist, warp or dents.

1. Scribe and cut panels at borders and penetrations to provide a neat, precise fit accurately into suspension system runners and edge moldings.

2. Field cut tegular type tile with a tegular reveal at all edge conditions. Touch up cut edge(s) with white paint to match ceiling tile.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 TOLERANCES

A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.

B. Maximum variation from plumb of grid members caused by eccentric loads: 2 degrees.

3.5 CLEANING

A. Properly clean surfaces of panels and open grids free from dirt and handling marks. Wherever surfaces cannot be cleaned by normal methods or have defects, remove and replace with new components.

B. Metal panels: Clean painted panels with a nonabrasive, non-solvent-based commercial cleaner. A soft cotton cloth is recommended.

C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

END OF SECTION

***
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prepare substrates to receive resilient tile flooring as required to insure specified tolerance level for finish surface. Preparation work includes patching, smoothing and leveling substrate, including:
   1. Grinding down high spots of substrate.
   2. Providing Portland cement-based latex underlayment (filler)

B. Furnish and install the following:
   1. Vinyl composition tile flooring.
   2. Resilient “flocked” floor covering.
   4. Rubber wall base.
   5. Resilient molding accessories.

1.2 RELATED SECTIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Application of protection paper to finished resilient flooring.

B. Section 03 30 00 – Cast-In-Place Concrete: Concrete substrate for resilient flooring, and concrete sealers.

C. Section 06 10 00 - Rough Carpentry: Platform framing and wood blocking and nailers.

D. Section 07 26 19 – Topical Moisture Vapor Management System; for controlling the moisture, alkalinity, and leveling the concrete substrate to acceptable finish flooring tolerances.

E. Section 09 29 00 - Gypsum Board: Gypsum board substrate to receive resilient base.

F. Section 09 65 19 - Rubber Flooring: Rubber tile and sheet flooring, rubber stair treads and risers.

G. Section 09 68 00 - Carpet: Carpet and transition strips.

H. Section 11 60 00 – Fixed Casework and Equipment: Location of fixed casework and equipment.

I. Division 14 - Section "Electric Traction Passenger Elevators" for elevator cab floor designated to receive rubber tile finish provided by Rubber Tile Floor Section.

J. Divisions 26 and 27: for electrical and/or telecommunication devices, fixtures, or access panels occurring in floor.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.
   1. ASTM E 84 - Surface Burning Characteristics of Building Materials.


5. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.


9. ASTM 1066 Class 2 – Through Pattern, Vinyl Composition Tile.

10. ASTM F 1861-98 – Type TP, Rubber Wall Base, Style – Cove.

11. ASTM F-1869 – Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride. See below for more information.


13. ASTM F 2170- Measuring percentage of Relative Humidity using In-Situ Probe.


15. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.


1.4 REGULATORY REQUIREMENTS

A. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of flooring and base trim.

B. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:

1. ASTM E 648 (Critical Radiant Flux) of 0.45 watts per sq. cm. or greater, Class 1.

2. ASTM E 662 (Smoke Generation) Maximum Specified Optical Density of 450 or less.

1.6 MOISTURE TESTING

A. Concrete testing results must be acceptable by Resilient Tile Flooring manufacturer and as follows:

1. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete:
   a. Must fall within 80% Relative Humidity required by flooring manufacturer.

2. ASTM F 1869-98 - “Standard Test Method for Measuring Moisture Emission Rate of a Concrete Subfloor Using Anhydrous Calcium Chloride”:

RESILIENT FLOORING AND ACCESSORIES

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a. Must meet a maximum MVER of 5 lb. per 1000 sq. ft. in 24 hours.

3. Alkalinity Test on the Concrete Slab:
   a. Must fall within a range of 5-9 as tested with pH Test Papers.

B. A reading outside of the above-specified limits requires mitigation measure prior to flooring installation.

1.7 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
   a. Provide confirmation and data that shows all flooring materials and adhesives meet the testing and product requirements of The California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.

2. Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.

3. Shop drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section. Drawings shall bear dimensions of actual measurements taken at the project.
   a. Identify each flooring type, colors and patterns; indicate layout of tile units and direction of tile patterns.
   b. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.
   c. Provide separate shop drawings for resilient flooring, base and transitions.

4. Selection samples: Manufacturers' sample chain of colors and patterns available for selection by Architect.

5. Verification samples:
   a. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.
   b. Resilient base: Each type and color selected, 24 inches long.
   c. Edging: 12 inches long demonstrating profile, thickness, size and color.

6. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.
   a. Mock-Up Size: Mock-up size as selected by Architect.
   b. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   c. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager's High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing;
indicate distance between extraction, harvesting, and recovery and the project site.

b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturers certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

3. VOC Content: Submit documentation showing VOC content for all materials submitted.


1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

B. Provide Types of Resilient tile and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

C. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver resilient flooring and base materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.

B. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

1.7 ENVIRONMENTAL CONDITIONS

A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work.

B. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.

C. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

D. Close spaces to traffic during floor covering installation.

E. Close spaces to traffic for 48 hours after floor covering installation.
1.9 WARRANTY

A. Provide warranties, commencing from the date of Substantial Completion, in accordance with Conditions of Contract and Division 01 Section 01 78 30 – “WARRANTIES AND BONDS”.

B. Manufacturer Warranty: Submit, for Owner's acceptance, manufacturer’s standard warranty agreeing to repair or replace resilient flooring that fails within the warranty period.
   1. Failures include, but are not limited to, the following:
      a. Material manufacturing defects.
      b. Surface wear and deterioration to the point of wear-through where normal foot and wheeled traffic is occurring or where the material is being properly maintained.
   2. Warranty Period: Ten (10) years commencing on Date of Substantial Completion.
   3. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

C. Installation Warranty: Submit the contractor’s installation warranty signed by the Construction Manager at Risk (CM-R) and Installer for Owner’s Acceptance, agreeing to repair or replace work which has failed as a result of defects in workmanship. Upon notification of such installation deficiencies, within the warranty period, make necessary repairs or replacement at the convenience of the Owner.
   1. Warranty Period: Two (2) year limited warranty commencing on Date of Substantial Completion from contractor.
   2. Installation warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1.10 EXTRA MATERIALS

A. Upon completion of the Work of this Section, deliver to the Owner extra flooring and base materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
   1. Resilient flooring: 3 percent of each material in each color, and pattern installed.
   2. Resilient Vinyl base: 24 linear feet of each type and color installed.
   3. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE FLOORING (VCT)

A. Description: Tile composed of polyvinyl chloride resin, plasticizers, fillers, stabilizers and pigments with colors and texture dispersed uniformly throughout its entire thickness.

B. Manufacturers: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers:
   1. Armstrong World Industries, Inc.
   2. Tarkett Inc.
   3. Altro USA, Inc.

C. Basis-of-Design: Standard Excelon by Armstrong Flooring, Inc
2. Size: 12 in. x 12 in.
3. Thickness: 1/8 in.
4. Colors: Vinyl Composition Tile (VCT) layout of colors and patterns shall be as indicated on drawings.
   a. Final color selections will be provided by the architect following product submittals review. After product submittals, colors and mockups are approved final vinyl composition tile (VCT) patterns will be released for ordering material for entire project. Refer to drawings for further information.
   b. Custom Laser Cut Logo: VCT tile shall be laser cut by manufacturer’s approved vendor with following manufacturer’s instructions.
5. Vinyl composition tile shall be SCS Floor Score Certified. Refer to drawings for size, shape and colors.

2.2 RESILIENT “FLOCKED” FLOOR COVERING (RC)

A. Description: Flocked high performance carpet tile with a 100% nylon type 6.6 wear layer with an intermediate fiberglass layer and a recycled vinyl cushioned backing.

B. Manufacturers: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers.
   1. Flotex Tile by Forbo Flooring
   2. LeadTex by Lianjing
   3. PurgoTex by LS Greenflor

C. Basis of Design: Flotex Canyon Sheet as manufactured by Forbo Flooring, Inc.
   1. Size: Approximately 79" Roll
   2. Gauge: 0.17"
   3. Backing: Vinyl
   4. Color and pattern: Flotex Canyon Sheet (RC) layout of colors and patterns shall be as indicated on drawings.
      a. Final color selections will be provided by the architect following product submittals review. After product submittals, colors and mockups are approved final Flotex Canyon Sheet (RC) patterns will be released for ordering material for entire project.

2.3 SLIP RESISTANT SHEET VINYL FLOORING (S)

A. Manufacturer: Subject to Architect's review for conformance with Contract Documents and the requirements specified herein, provide products from one of the following listed manufacturers.
   1. Altro USA, Inc.
   2. Gerflor USA.
   3. Polyflor America, Inc.

B. Basis of Design for Slip Resistant Sheet Vinyl Flooring: Stronghold 30 as manufactured by Altro USA, Inc. designated on the Floor Finish Plans as “S”.
   2. Roll/Sheet Width & Length: 6' feet 7 inches (2 m) x 66 feet.
3. Wear Layer/Overall Thickness: 3.0 mm (0.12 inches), with non-directional pattern and slip retardant particulate suspended evenly throughout the product thickness.
7. Fire Performance: ASTM E 648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I, ASTM E662 Smoke Development.
8. Sustainable Properties: Phthalate-free, SCS FloorScore Certified, meets CAL Section 01350, contributes to LEED credits for recycled content, adhesives, low VOC emitting material. EPD Environmental Product Declaration and HPD Health Product Declaration Available.
9. Colors: Colors and patterns shall be as indicated on drawings.

2.4 RUBBER WALL BASE (RB)

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
   1. Tarkett Inc.
   2. Roppe Corporation.
   3. Nora System, Inc

B. Basis of Design for RB: Traditional Rubber Wall Base by Tarkett Inc.
   1. Manufactured from a proprietary rubber formulation designed specifically to meet the performance and dimensional requirements of ASTM F 1861 Standard Specification for Resilient Wall Base, type TP, Group 1 (solid), and Style A and B.
   2. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1/4" diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
   5. Fire resistance: ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.

C. Style: DC-XX with Toe.
   1. Height: 4 inches.
   2. Length: 120 feet rolled coil.

D. Colors: Up to 8 colors will be selected by Architect.

E. Base accessories: Premolded end stops of same material, size and color as base. Job-form all external and internal corners from base material; pre-molded corner pieces will not be acceptable.
2.5 RESILIENT MOLDING ACCESSORIES

A. Manufacturer: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
   1. Tarkett Inc.
   2. Roppe Corporation.
   3. Nora System, Inc

B. Types Include the following as applicable: Cap for cove carpet, cap for cove resilient sheet floor covering, carpet edge for glue-down applications, nosing for carpet, nosing for resilient floor covering, reducer strip for resilient floor covering, joiner for tile and carpet.
      a. Hardness: ASTM D 2240 - Not less than 85 Shore A.
      b. Abrasion Resistance: ASTM D 3389 - 0.22 mg/cycle.
   2. Edge strips: Tapered or bull nose edge.
   3. Profile and Dimensions: As indicated on drawings.
   4. Colors: As selected by the Architect from standard colors available.

2.6 INSTALLATION MATERIALS

A. Note all setting materials and adhesives are intended to be “Low VOC” products complying with LEED Requirements and procedures.

B. Filler for patching, smoothing and leveling subfloors and underlayment: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
   1. Ardex, Inc., products “Feather Finish” and “Ardex SD-P”.
   2. Quikrete Companies, product “Fast-Set Underlayment 1248”.

C. Adhesives:
   1. General: Waterproof, acceptable to the resilient flooring manufacturer, for substrate conditions.
   2. Use adhesives certified as low-emitting materials in accordance with either the Scientific Certification System’s Indoor Advantage Gold program, Scientific Certification System’s FloorScore program, or GreenGuard’s Children and Schools program3.
   3. Provide adhesive that is acceptable to the flooring manufacturer to suit resilient products and substrate conditions indicated.

D. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
B. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test.

C. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

A. General: Comply with flooring manufacturer's requirements for preparation of substrate to receive resilient flooring.

1. Close spaces to traffic during the installation of the flooring.

B. Remove, by light sanding and grinding, all protruding edges, high spots. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.

C. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler. Apply, trowel and float finish subfloor filler and leave a smooth, level, hard surface. Prohibit traffic from area until filler is cured.

D. Vacuum clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring.

E. Any finished flooring exhibiting defects resulting from improper preparation of substrate will be cause for rejection and replacement at the Contractor's expense.

3.3 INSTALLATION - GENERAL

A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.

1. Apply primers as recommended by adhesive manufacturer's written instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Mix tile to ensure that concentration of surface patterns is uniform throughout. Use tile from cartons in same sequence as manufactured and packaged, if so numbered.

3.4 INSTALLATION - TILE

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated on drawings.

2. Do not install resilient flooring over expansion joints.

B. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material or color.

C. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.

D. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.
E. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Installation of logo

3.5 INSTALLATION - SHEET

A. Unroll floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out floor coverings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading at seams.
   4. Avoid cross seams.

C. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

G. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces, if required by manufacturer.
   1. Integral-Flash-Cove Base: Cove floor coverings up vertical surfaces as indicated on Drawings. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.6 INSTALLATION OF RUBBER BASE

A. Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework and other permanent fixtures in areas where base is required.
   1. Install in lengths as long as practical.
   2. Scribe to fit to doorframes and other interruptions.
   3. Form all external and internal corners in accordance with manufacturers written instructions. Cope inside corners and fit neatly.
   4. Fill voids with plastic filler along the top edge of the resilient wall base on masonry surfaces or other similar irregular substrates.
3.7 INSTALLATION OF RESILIENT MOLDING ACCESSORIES

A. Resilient edge and transition strips:
   1. Install edge strips at all edges of flooring, which would otherwise be exposed.
   2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.8 PROTECTION

A. Prohibit traffic on finished floor areas until flooring adhesive has fully set.

B. Prohibit washing, scrubbing or other similar ‘wet’ operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.

C. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover the all resilient tile floor surfaces with non-staining heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection. Provide thicker material where necessary to protect flooring from heavier loads and other trades in high traffic areas that will be utilizing finished flooring.

3.9 POST-INSTALLATION CLEANING

A. Comply with manufacture’s written instructions for cleaning and protection of resilient products.

B. As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.
   1. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. Any finished flooring exhibiting damage resulting from improper protection will be cause for rejection and replacement at the Contractor’s expense.

C. Sweep floors to remove all loose dirt and debris.

D. Damp mop surface to remove marks and soil.

E. After specified waiting period, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.
   1. No traffic for 24 hours after installation of tile.
   2. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
   3. Wait 72 hours after installation before performing initial cleaning.

F. Vinyl composition tile: Initial Maintenance – Immediately After Installation
   1. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dust, dirt, grit, and debris.
   2. Remove any dried adhesive residue with a clean, white cloth dampened with mineral spirits, carefully following warnings on the container.
   3. Damp mop the floor with a properly diluted neutral (pH 6 to 8) detergent solution, such as Armstrong Flooring S-485 Commercial Floor Cleaner.
   4. Apply a minimum of 2 coats of a high-quality commercial floor polish (such as Armstrong Flooring S-480 Commercial Floor Polish) to temporarily protect the floor until regular maintenance procedures can begin. The use of a high-quality stain-resistant sealer (such as Armstrong Flooring S495 Commercial Floor Sealer) beneath
the polish should be considered in areas of high traffic, high soil load and areas where staining potential is high.

3.10 FINAL CLEANING

A. General: Perform final cleaning not before 5 days prior to Owner's intended occupancy date.

B. Vinyl composition tile floors:
   1. Machine scrub the floor with a properly diluted neutral (pH 6 to 8) detergent solution (such as Armstrong Flooring S-485 Commercial Floor Cleaner) and a scrubbing pad (3M™ blue or equal) or equivalent brushes. If the floor is badly soiled and/or scratched, strip it using the same procedure, but substituting a properly diluted stripping solution.
   2. Thoroughly rinse the entire floor with fresh, clean water. Remove rinse water and allow the floor to dry completely.
   3. Apply 3 to 5 coats of high-quality commercial floor polish, such as Armstrong Flooring S-480 Commercial Floor Polish. If the floor has been stripped, the application of a stain resistant sealer (such as Armstrong Flooring S-495 Commercial Floor Sealer) prior to the application of polish, is recommended in areas that will be exposed to heavy traffic and/or staining agents.

3.11 PROTECTION

A. After cleaning and polishing, ensure that the flooring is be protected with heavy kraft paper, maintained until Substantial Completion.

END OF SECTION
***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Furnish necessary material, labor, and equipment required to prepare designated areas and install Resinous Flooring and Cove Base System.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Division 01 – Section Concrete Floor Moisture & pH Testing for concrete floor testing requirements.
2. Division 03 - Section “Cast-In-Place Concrete” For water vapor transmission inhibiting admixture installed within the concrete floor substrates and moisture testing of concrete floor substrates prior to installation of floor finishes.
3. Division 07 – Section “Topical Moisture Vapor Management System”.
4. Division 08 - Section “Door Hardware”: for thresholds at door openings.
5. Section 09 – Finishes: for abutting flooring and wall finishes.
6. Division 22 - Section “Plumbing”: for floor drains and plumbing fixtures penetrating the finish flooring; trench drains requiring continuous resinous flooring finish.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Obtain Flooring System materials from a single manufacturer with a minimum of 10 years verifiable experience providing materials of the type specified in this section.

B. Contractor's Qualifications: Installation must be performed by a manufacturer certified contractor with skilled mechanics having not less than three years satisfactory experience in the installation of the type of system as specified in this section and must be certified in writing by the manufacturer of the specified Flooring System.

C. Floor System Thickness Verification: At the owner's discretion, installed thickness can be verified by an independent testing firm by taking random cores through the system into the substrate. Cored areas less than specified thickness shall be removed and replaced or increased in thickness by the installing contractor, in a manner that does not affect the performance or integrity of the system. Cored areas which comply with the recommended system thickness shall be built-up to match the surrounding surface elevation prior to
applying the seal coat(s). Cores taken and patched will be noticeable; therefore, cores should be taken from areas where aesthetics are less critical.

1.5 SUBMITTAL

A. System Data Submit manufacturer's specifications on cured system and individual components of the Flooring System, including physical properties and performance properties and tests. Each individual component of the system will be evaluated on the basis of these standards. For any tests not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data accompanied by the independent testing laboratory's test results which prove compliance in accordance with the referenced standard(s). Manufacturer's standard color chart shall also be submitted.

B. The contractor shall submit a 6" x 6" cured system sample which the contractor has made for verification purposes and finish texture approval.

C. The contractor shall furnish a list of projects using either specified material or equivalent that they have installed during the last 3 years. Information shall include project name, square footage, owner contact name with owner's address and phone number. Also, the contractor shall furnish résumés detailing the experience of key project personnel including supervisors and mechanics.

D. The contractor shall submit a copy of the manufacturer's packing slip, tagged for this specific job, along with calculations, signed by an officer of the primary material supplier demonstrating that the quantity of material furnished for the project will achieve the specified coverage and mil thickness.

E. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager's High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturer's certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

3. VOC Content: Submit documentation showing VOC content for all materials submitted.


1.6 CONCRETE FLOOR MOISTURE and pH TESTING REQUIREMENTS

A. NEW SLABS
Concrete floor moisture and pH tests shall be performed by the Owner's Testing Agency under Division 1, Section 01 45 90, to verify that the test results are acceptable by resinous flooring manufacturer and meet the following:

1. Moisture testing to verify that moisture rating (RH & MVER) meet the manufacturers requirements for the approved products.
2. Alkalinity Test on the Concrete Slab:
   a. Must fall within a range as approved by the manufacturer.

   The Contractor for the Work of this Section shall obtain the results and unacceptable conditions or a reading outside of the above-specified limits shall be reported to Construction Manager for substrate mitigation measure prior to flooring installation.

1.7 MATERIAL DELIVERY, HANDLING AND STORAGE

A. Primary system materials shall be delivered in the manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the following:
   • Product name(s) and/or Number(s)
   • Manufacturer's name
   • Component designation (A, B, etc.)
   • Product Mix Ratio
   • Health and Safety Information
   • CHEMTREC Emergency Response Information

B. Provide equipment and personnel to handle the materials by methods which prevent damage.

C. The contractor shall promptly inspect direct jobsite material deliveries to assure that quantities are correct, comply with requirements and are not damaged.

D. The contractor shall be responsible for materials furnished by him, and he shall replace, at his own expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling or storage.

E. Store material(s) in accordance with manufacturer's instructions, with seals and labels intact and legible. Maintain temperatures within the required range. Do not use materials which exceed the manufacturer's maximum recommended shelf life.

1.8 JOB CONDITIONS

A. The contractor shall visit the jobsite prior to beginning the installation of the Flooring System to evaluate substrate condition, including substrate moisture content, and the extent of repairs required, if any. Concrete substrates shall be tested to verify that the moisture content of the substrate does not exceed the Flooring System manufacturers' recommendations.

B. The contractor should exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, as well as in-place equipment. The contractor shall prepare the substrate to remove laitance and open the surface. This shall be achieved by light brush grit blasting. Surface profile achieved shall be similar to medium grit sandpaper and free from bond-inhibiting contaminants. Costs incurred that are associated with damage from negligence or inadequate protection shall be the sole responsibility of the contractor.

C. Sub floor tolerances are specified in Division 3 Section “Cast-In-Place Concrete” (in accordance with ACI 302). Each drain in the installation area must be working and raised or lowered to the actual finished elevation of the 1/8" Decorative Slurry/Broadcast Epoxy Flooring System.

D. System must be protected by the General Contractor or, as a separate bid item, by the installing contractor until it is inspected and turned over to the owner.
E. The minimum slab temperature must be conditioned to 50°F before commencing installation, during installation, and for at least 72 hours after installation is complete.

F. Maintain lighting at a minimum uniform level of 50 or more foot candles in areas where the Flooring System is being installed. It is the recommendation of the manufacturer that the permanent lighting be in place and working during the installation.

G. Leaks from pipes and other sources must be corrected prior to the installation of the 1/8" Decorative Slurry/Broadcast Epoxy Flooring System.

1.9 WARRANTY

A. The contractor and the manufacturer shall furnish written warranty covering 100% of the material and labor cost protecting client from delamination, disbondment, and osmotic/hydrostatic failure for a period of three (3) years from the date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal as approved by Architect:

1. Dur-A-Flex Inc.,
2. Tnemec Company, North Kansas City, MO

B. Basis of Design:


2.2 EPOXY FLOORING AT KITCHEN AREA (EF-1)

A. System Materials:

1. Topping: Poly-Crete MD resin, hardener, and MD aggregate by Dur-A-Flex.
   a. The aggregate shall be Flintshot quartz aggregate by Dur-A-Flex.

B. Patch Materials


C. Typical Physical Properties

1. Topping: Poly-Crete MD
   a. Percent Reactive: 100 %
   b. VOC: 0 g/L
   c. Bond Strength to Concrete ASTM D 4541: >400 psi, substrates fail
   d. Compressive Strength, ASTM C 579: 9,000 psi
   e. Tensile Strength, ASTM D 638: 2,175 psi
f. Impact Resistance @ 125 mils, MIL D-3134: >160 inch lbs
   No visible damage or deterioration

2. Top Coat: Poly-Crete TF PLUS
   a. Percent Reactive: 100%
   b. VOC: 0 g/L
   c. Compressive Strength, ASTM C 579: 7,250 psi
   d. Tensile Strength, ASTM D 638: 750psi
   e. Flexural Strength, ASTM D 790: 4,400psi
   f. Abrasion Resistance, ASTM C 501
      PDS-Taber CS17, 1,000gm load, 1,000 cycles: 40mg weight loss
   g. Hardness, Shore D: 85
   h. Potlife @77 F: 15 minutes

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates, areas, and conditions, with Applicator present, for compliance with
      requirements for maximum moisture content, installation tolerances and other conditions
      affecting flooring performance.
      1. Verify that substrates and conditions are satisfactory for flooring installation and
         comply with requirements specified.

3.2 SURFACE PREPARATION
   A. General
      1. Concrete surfaces shall be free of oil, grease, curing compounds, loose particles,
         moss, algae growth, laitance, friable matter, dirt, and bituminous products.
      2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
         a. Perform relative humidity test using is situ probes, ASTM F 2170.
            Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
         b. If the relative humidity exceeds 99% then the Owner and/or Engineer
            shall be notified and advised of additional cost for the possible
            installation of a vapor mitigation system that has been approved by the
            manufacturer or other means to lower the value to the acceptable limit.
      3. Mechanical surface preparation:
         a. Shot blast all surfaces to receive flooring system with a mobile steel shot,
            dust recycling machine (Blastrac or equal). All surface and embedded
            accumulations of paint, toppings hardened concrete layers, laitance,
            power trowel finishes, and other similar surface characteristics shall be
            completely removed leaving a bare concrete surface having a minimum
            profile of CSP 4-6 as described by the International Concrete Repair
            Institute.
         b. Floor areas inaccessible to the mobile blast machines shall be
            mechanically abraded to the same degree of cleanliness, soundness and
            profile using diamond grinders, needle guns, bush hammers, or other
            suitable equipment.
         c. Wherever a free edge will occur, including doorways, wall perimeters,
            expansion joints, columns, doorways, drains and equipment pads, a ¼
            inch deep by 1/4 inch wide keyways shall be cut in.
d. Cracks and joints (non-moving) greater than 1/4 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.

4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.2 INSTALLATION

A. General
1. The system shall be applied in three distinct steps as listed below.
   a. Substrate preparation
   b. Topping/overlay application with quartz aggregate broadcast.
   c. Resin application with quartz aggregate broadcast.
   d. Grout coat application
   e. Topcoat application
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Topping
1. The topping shall be applied as a self-leveling system as specified. The topping shall be applied in one lift with the nominal thickness as recommended by the manufacturer.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using a pin rake, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a roller as recommended by the manufacturer.
6. Depends on the system Flintshot aggregate or Q28 aggregate shall be broadcast to excess into the wet material at the rate of 1 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

E. Topcoat
1. The topcoat shall be applied with a coverage rate of 45 sf/kit.
2. The finish floor will have a nominal thickness of 1/4 inch.

3.3 FIELD QUALITY CONTROL

A. Test and Inspection
1. The following test shall be conducted by the applicator:
   a. Temperature: Air, substrate temperatures and, if applicable, dew point
   b. Coverage Rates: Rates for all layers shall be monitored by checking quantity of material used against the area covered.
3.3 CURING, CLEANING AND PROTECTION

A. Cure the Decorative Flooring System materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.

B. Protect the Flooring System from damage and wear during other phases of the construction operation, using temporary coverings as recommended by the manufacturer, if required. Remove temporary covering just prior to final inspection.

C. Clean the Flooring System just prior to final inspection, using materials and procedures suitable to the system manufacturer.

END OF SECTION
***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Digital Vinyl Wall Covering.

1.3 RELATED SECTIONS

A. Section 09 29 00 – GYPSUM BOARD: for gypsum board substrate.

B. Section 09 30 13 – CERAMIC TILE for floor material.

C. Section 09 90 00 – PAINTING for primers.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.
   1. Performance characteristics:
      a. NFPA Class A fire rating.
      b. Surface burning characteristics as determined by ASTM E-84
      c. Impact strength in accordance with the applicable provisions of ASTM D5420.
      d. Chemical and stain resistance in accordance with applicable provisions of ASTM D-543.
      e. Fungal and Bacterial Resistance in accordance with ASTM G-21 and ASTM G-22.


1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
   1. Literature: Manufacturer's product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.
a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.

b. Include certified test reports together with complete description of each material.

c. Provide confirmation and data that shows all adhesives and setting materials meet the testing and product requirements of The California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.

2. Shop drawings showing locations, extent and installation details of wall covering products.

3. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern, and thickness:

   a. Sample of each product specified available in 8” x 8” size.
   
   b. Available colors: solid, woodgrain & patterns, and textures.”

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

   1. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
      
      b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

   2. Recycled content: Manufacturer’s certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

   3. VOC Content: Submit documentation showing VOC content for all materials submitted.


1.6 QUALITY ASSURANCE

A. Imperfections such as engraving roller die marks, roller repeat marks or other features deemed not in conformance with the specified materials, will be cause for rejection by the Architect, if evidenced in either the submitted samples, or the manufactured material delivered to the job site.

B. Manufacturer’s qualifications: Not less than 5 years’ experience in the production of specified products and a record of successful in-service performance.

C. Applicators Qualifications: Work of this section shall be performed by a firm regularly engaged in the installation of wallcoverings of the types and qualities specified, and acceptable to the Architect.

D. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, and Life Safety.

E. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.
F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141.

1.7 PROJECT SITE CONDITIONS

A. Temperatures:
   1. Materials must be acclimated in an environment of 65-75°F (18-24°C) for at least 24 hours prior to beginning the installation.
   2. Installation areas must be enclosed and weatherproofed before installation commences.
   3. Maintain substrate surface and ambient temperatures above 65 degrees F, unless required otherwise by manufacturer’s instructions.
   4. Do not apply adhesive when the substrate surface temperature or ambient temperature is below 65 degrees F.
   5. Maintain these conditions 72 hours before, during and after installation of wallcovering.

B. Lighting: Provide not less than 80 foot-candles per square foot minimum, on the surfaces to receive wallcoverings.

C. Wall Condition:
   1. The wall surface should be clean, dry, structurally sound and free of mildew, grease, dust, or other stains.
   2. Plaster and masonry wall surfaces should not exceed 5.5% moisture when measured by a moisture meter. Gypsum board wall surfaces should not exceed 16% moisture.
   3. Room humidity should not exceed 90%.

1.8 WARRANTY

A. Submit manufacturer’s written five-year warranty against manufacturing defects.
   1. All wallcovering materials when adhered to a sound surface with the manufacturer’s recommended procedures and adhesive, shall be warranted free of manufacturing defects for a period of 5 years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 DIGITAL VINYL WALL COVERING (VWC)

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. Rampart by Wolf Gordon, Inc.
   2. Duratec by MDC Interior Solutions, LLC.
   3. Flex Decorative Wall Protection by Koroseal Interior Products LLC.

B. Basis of Design (VWC): Digital Rampart Wall Covering as manufactured by Wolf Gordon, Inc.

C. Physical Properties:
   1. Content: 100% Vinyl.
3. Finish: Stain Resistant Treatment.
4. Width: 52” – 54”
5. Weight: 35 oz per linear yard
7. Color:
   a. VWC-1: Custom digital image will be provided by architect.
   b. VWC-2: Custom digital image will be provided by architect.
8. Trim: Provide color matching or clear outside corner protection.
9. Adhesive: As recommended by manufacturer.

D. Performance characteristics:
1. Fire rating: Class A, as per ASTM E84.
2. ASTM F793 Type III Wallcovering.
4. Surface Indentation – ASTM D5420: Meets Level 2
5. Hard Body Impact – ASTM C1629: Level 1
7. Scuff Resistance – ASTMD1308: Meets
8. Effect of Chemical Cleaning Agents – ASTM D1308: No damaging effect
9. Low VOC Emitting:
   b. Use of Harmful Chemicals: Complies with MRc4 LEED v4
   c. GREENGUARD GOLD Indoor Air Quality Certified for low VOC emissions.

2.2 FABRICATION

A. Comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thicknesses of components.

B. Shop-assemble components to the greatest extent possible. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of evidence of wrinkling, chipping, uneven coloration, dents, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of members to other construction.

2.3 ACCESSORIES

A. Provide all accessories, including but not limited to color matched caulk, setting materials, adhesives and primers as recommended by the wallcovering/display board manufacturer.

B. Note all setting materials and adhesive materials are intended to be “Low VOC” products complying with LEED Requirements and procedures.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
B. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION
A. Comply with manufacturer's written instructions for surface preparation.
B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
   1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   2. Gypsum Board: Prior to priming and skim coating, seal damaged drywall facing paper. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
   3. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
D. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.
E. Coordinate the work of this Section with the operable partitions manufacturer / contractor to ensure that adhesives, surface preparation and mounting techniques are all optimal and as recommended by manufacturer for surfaces to receive wall covering.

3.3 INSTALLATION
A. Temperature at the time of installation must be between 65-75°F (18-24ºC) and be maintained for at least 48 hours after the installation to allow for proper adhesive set-up.
B. Relative humidity shall not exceed 80%.
C. Do not expose wall covering to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.
D. Install the work of this section in strict accordance with the manufacturer's recommendations using approved adhesive.
   1. Locate the wall covering as indicated on the approved detail drawing for the appropriate substrate and in compliance with the manufacturer's installation instructions. Install level and plumb at the height indicated on the drawings.
   2. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.
   3. Install all trims pieces, and other accessories in strict accordance with the manufacturer's instructions.
3.4 CLEANING AND MAINTENANCE

A. Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.

B. Upon completion of the work, remove surplus materials, rubbish and debris resulting from the wallcovering installation. Leave areas in orderly condition.

C. Remove stains promptly to prevent any possible reaction between the staining agent and the wallcovering that could cause permanent discoloration.

D. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION
***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

Furnish and install fiberglass reinforced plastic wall panels where shown on the Drawings.

A. Related Sections: Section(s) related to this section include:
   1. Section 04 20 00 – Unit Masonry Assemblies: for masonry substrate.
   2. Section 09 29 00 – Gypsum Board: for gypsum substrates.
   3. Section 09 51 00 – Acoustical Ceiling: for adjacent ceiling construction.

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation

B. ASTM International:


1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide fiberglass reinforced plastic (FRP) panels which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.
B. Product Data: Submit product data, including manufacturer’s product sheet, for specified products.
   1. Provide confirmation and data that shows all adhesives meet the testing and product requirements of The California Department of health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

D. Samples: Submit selection and verification samples for finishes, colors and textures. Submit 2 samples of each type of panel, trim and fastener.

E. Quality Assurance Submittals: Submit the following:
   1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
   3. Manufacturer’s Instructions: Manufacturer’s installation instructions.
   4. Manufacturer’s Field Reports: Manufacturer’s field reports specified herein.

F. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 01 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Warranty: Warranty documents specified herein.

G. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:
   1. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.
   2. Recycled content: Manufacturers certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.
   3. VOC Content: Submit documentation showing VOC content for all materials submitted.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

2. Manufacturer Qualifications: Manufacturer should be capable of providing field service representation during construction and should be capable of approving application method.

B. Regulatory Requirements:
1. Comply with applicable local, state and federal codes.

1.7 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements Sections.

B. Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store panels indoors in a dry place at the project site.

E. Handling: Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete, ceramic tile or resinous flooring work has dissipated.

2. During installation, and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.

3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. Warranty Period: 10 years commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. Manufacturer: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following offering products which may be incorporated in the work include the following:

1. Crane Composites, Inc.
2. Marlite Inc.
3. Panolam Inc.

B. FRP-1 Basis of design: Glassboard FX as manufactured by Crane Composites.
   1. Fire rating: Class A.
   3. Scratch Resistance, ASTM D 2583, Barcol Hardness: 40
   4. Abrasion Resistance: Taber Abrasion Test, CS-17 abrasive wheels with 1,000 g weight: Weight loss after 25 cycles of no more than 0.038 percent.
   5. Impact Strength, ASTM D 5420: 45 in-lbs (5.1 J), showing no visible damage on finish side.
   7. Color: to be selected by the Architect from the manufacturer’s standard range of colors.
   8. Moldings: Provide harmonizing PVC (polyvinyl chloride) moldings (color to be selected by the Architect from the manufacturer’s standard range of colors).
      a. Rivets: Provide rivets at locations as required by panel manufacturer.

C. FRP-2 Basis of design: Designs – Classic Collection manufactured by Crane Composites.
   1. Fire rating: Class A.
   2. Surface Texture: Smooth texture.
   3. Scratch Resistance, ASTM D 2583, Barcol Hardness: 40
   4. Abrasion Resistance: Taber Abrasion Test, CS-17 abrasive wheels with 1,000 g weight: Weight loss after 25 cycles of no more than 0.038 percent.
   5. Impact Strength, ASTM D 5420: 45 in-lbs (5.1 J), showing no visible damage on finish side.
   7. Pattern: Canvas
   8. Color: to be selected by the Architect from the manufacturer’s standard range of colors.
      a. Rivets: Provide rivets at locations as required by panel manufacturer.

2.2 ACCESSORIES
A. Note all adhesives are intended to be “Low VOC” products complying with LEED Requirements and procedures.
B. Adhesive: Provide Low VOC panel adhesive as recommended by panel manufacturer.

C. Panel Seam Sealant: Bright white, 2-part urethane sealant, as recommended by FRP panel manufacturer.
   1. VOC Content: 0.0 g/L.

D. Provide all other accessories as required by panel manufacturer, including but not limited to color matching moldings, J-trim, heavy-duty corners batten strips and fasteners.

2.3 RELATED MATERIALS
A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

2.4 SOURCE QUALITY
A. Source Quality: Obtain fiberglass reinforced plastic (FRP) panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 - EXECUTION
3.1 MANUFACTURER’S INSTRUCTIONS
A. Compliance: Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION
A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.
   1. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk and joints and cracks are filled flush and smooth with the adjoining surface.
   2. Do not begin installation until backup surfaces are in satisfactory condition.

3.3 PREPARATION
A. Clean substrates to remove substances that could impair bond of adhesive, including oil, grease, dirt, dust, or other contaminate.
B. Acclimate FRP panels by unpacking and placing in installation space a minimum of 24 hours before installation.
C. Lay out FRP panels before beginning installation.
   1. Locate panel joints to provide equal panel widths at ends of walls.
   2. Locate panel joints to provide trimmed panels at corners a minimum of 12 inches (300 mm) wide.

3.4 INSTALLATION
A. Fiberglass Reinforced Panel (FRP) Installation:
   1. Install FRP panels in accordance with manufacturer’s instructions at locations indicated on the Drawings.
   2. Install FRP panels plumb, level, square, flat, and in proper alignment.
   3. Install FRP panels to be water resistant and washable.
   4. Install panels with manufacturer’s recommended gap for panel field and corner joints.

FIBERGLASS REINFORCED PLASTIC WALL PANELS
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5. Pre-drill fastener holes in panels with 1/8 inch (3.2 mm) oversize.
6. For trowel type and application of adhesive, follow adhesive manufacturer’s recommendations.

B. Adhesive:
   1. Install FRP panels in full spread of adhesive.
   2. Follow adhesive manufacturer’s instructions for application of adhesive.

C. Install trim accessories with adhesive and nails or staples:
   1. Do not fasten through FRP panels.

D. Sealant:
   1. Fill grooves in trim accessories with sealant before installing FRP panels.
   2. Bed inside corner trim in bead of sealant.
   3. Remove excess sealant and smears as FRP panels are installed.
   4. Clean in accordance with sealant manufacturer’s instructions

E. Tolerances: Install FRP panels within manufacturer’s installation tolerances.

F. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related materials installation.

3.5 FIELD QUALITY REQUIREMENTS

A. Manufacturer’s Field Services: Upon Owner’s request, provide manufacturer’s field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer’s instructions.

3.6 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer’s instructions prior to Owner’s acceptance. Remove construction debris from project site and legally dispose of debris.

   1. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

3.7 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SECTION INCLUDES

A. Furnish and install back mounted acoustical wall panels with impact-resistant face including the following:
   1. Fabric wrapped acoustical wall panels.

1.3 RELATED SECTIONS

A. Section 04 20 00 – UNIT MASONRY ASSEMBLIES: Masonry substrates.

B. Section 06 10 00 – ROUGH CARPENTRY: Concealed wood blocking and nailers.

C. Section 09 22 00 – METAL SUPPORT ASSEMBLIES: Non-load bearing partition framing and furring.

D. Section 09 29 00 – GYPSUM BOARD: Finished wall surfaces.

B. Division 26 - ELECTRICAL: For providing openings in panels around electrical devices.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 – REFERENCE STANDARDS AND DEFINITIONS.
   1. ASTM C 423 - Test Method for Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method.
   4. NFPA 701 - Vertical Burn Test.
   5. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.


1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, and acoustical performance data for each item listed under this section.
   a. Note on submittals any deviations from specified requirements and the reasons thereof.

2. Material certificates: Provide for the following, signed by panel fabricator and Contractor certifying that upholstered system complies with the specified flame spread and acoustical requirements.

3. Panel fabricator's field installation/setting instructions.


5. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

6. Shop drawings:
   a. Dimensioned 1/4 inch scale elevations, bearing dimensions of actual measurements taken at the project, where practical. Indicate on elevations, arrangement of joints, and panel identification numbers for ease of installation.
   b. Large scale design details showing attachment method; edge and joint conditions.

7. Selection samples: 12 by 12 inch square sample of all fabric selections, from dye lots to be used on the project.

8. Verification samples: 24 by 24 inch samples of completed fabric panel assembly mounted to a hardboard substrate using specified mounting system. Sample shall illustrate selected edging profiles, facing fabric and mounting system.

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturer's certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

3. VOC Content: Submit documentation showing VOC content for all materials submitted.


1.6 QUALITY ASSURANCE

A. Fire performance characteristics: Fabric panel assembly tested in accordance with ASTM E 84 with gypsum wall board substrate, is UL rated Class A, with the following results.

1. Flame Spread: 25 or less.

2. Smoke Developed: 450 or less.
B. Single Source Responsibility for Acoustical Wall Panels: Obtain each type of acoustical wall panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the progress of the Work.

C. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

B. Do not deliver fabric panel materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.

C. Deliver prefabricated panels to site with concealed panel identification numbers corresponding to identical numbers on shop drawings. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.

D. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.8 PROJECT CONDITIONS

A. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of upholstered wall system, and maintain until Owner's Final Acceptance.

1.9 FIELD MEASUREMENTS

A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication of acoustical wall panels without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.10 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels:

1. Acoustical Wall Panels: Furnish quantity of full size units equal to 3 percent of the amount installed.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.

1. Failure in performance includes, but is not limited to, acoustical performance.
2. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
3. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FABRIC WRAPPED ACOUSTIC PANEL MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following offering products which may be incorporated in the work include the following:
   1. Decoustics Ltd.
   2. MBI Products Company.

B. Basis of design: Type AP as manufactured by Decoustics.

2.2 FABRIC WRAPPED ACOUSTIC PANEL CORE MATERIALS

A. System: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with chemically hardened edges. The finish shall be flat and wrinkle free and fully tailored at corners with no exposed darting.
   1. Nominal Core Thickness: 1" and 2". Refer to drawings.
   2. Overall System NRC: Not less than 0.85 per ASTM E 795.
   3. Panel Width and Height: As indicated on Drawings.
   4. Panel Edge Detail: Chemically hardened square edges.
   5. Corner Detail: Fully tailored at corners with no exposed darting.

2.3 ACOUSTIC PANEL FABRIC

A. Manufacturer: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:
   1. Knoll Textiles
   2. Carnegie
   3. Maharam

B. Fwap-1:
   1. Manufacturer: Knoll Textiles
   2. Style: Hourglass
   3. Color: TBD
   4. Thickness: 1"

C. Fwap-2:
   1. Manufacturer: Knoll Textiles
   2. Style: Hourglass
   3. Color: TBD
   4. Thickness: 1"

D. Fwap-3:
   1. Manufacturer: Knoll Textiles
PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.

F. Verify gypsum board surface is within specified tolerances, and has been taped, sanded smooth and primed.

G. Verify electrical receptacles, switch-boxes and other similar wall penetrations that have been sealed to prevent air leakage.

H. Ensure that work which will be concealed by Work of this Section, has been permanently installed, inspected, and approved.

I. Notify Architect in writing when project conditions are unacceptable to fabric system Installation. Beginning of installation means acceptance of substrate and project conditions.

J. Coordinate with other trades to provide openings within panels around electrical and technology devices, see detail on AF3-0-2.

3.2 INSTALLATION - MECHANICAL CLIPS

A. Perform installation in accordance with manufacturers written instructions for the installation method specified. Obtain Architect’s written direction if field conditions prohibit installation using specified fastening system.

B. Locate and install appropriate wall fasteners on receiving substrate surface.

C. Fabricate system so that frames or mounting members of the system shall not telescope through the face of the fabric.

D. Install acoustical wall panels in exact position corresponding with panel identification number on approved shop drawings.

E. Install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels. Butt joint panels without gaps.

F. Align pattern, texture and grain of fabric at seams and throughout the entire panel wall without distortion to the geometry of the fabric or its pattern.

3.3 TOLERANCES

A. Maximum variation of panels from true location: Plus or minus 1/8 inch.

B. Maximum variation of surfaces intended to be flush: plus or minus 1/32 inch.
3.4 FIELD QUALITY CONTROL
   A. Field inspection will be performed by the Architect. Remove and replace panels which are
damaged, contain adhesive on the fabric or seams, are soiled or otherwise found
unacceptable to the Architect.

3.5 CLEANING AND ADJUSTING
   A. Adjust panels dislodged from indicated position, plumb and level.
   B. Daily clean work areas by sweeping and disposing of debris and scraps.
   C. Upon completion of the work of this Section, remove tools, equipment and all rubbish and
debris from the work area. Leave area in broom-clean condition.
   D. Clean surfaces of upholstered panels free from dirt and handling marks using methods and
materials recommended by panel system manufacturer. All upholstered surfaces which
cannot be cleaned, or which are otherwise damaged shall be removed and replaced with
new work in conformance with the Contract Documents.

3.6 PROTECTION
   A. Protect panels from soiling or other damage, until Final Acceptance of Contract by Owner.

END OF SECTION
***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY

A. This Section consists of painting work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Painting work includes but is not limited to the surface preparation and application of coated finishes, and subsequent touch-up, of interior and exterior items and surfaces as indicated on the Drawings and/or as scheduled herein.

B. No attempt is made in this section to list all surfaces, fixtures and equipment requiring painting on this project. It is the responsibility of the subcontractor to determine for itself the scope and nature of the Work required for a complete installation from the information provided herein and in the Drawings.

1. Scope of painting work: In general, without limiting the generality thereof, the following surfaces, fixtures and equipment require a painted finish:
   a. Gypsum board partition and wall surfaces.
   b. Concrete Masonry Unit partitions and interior wall surfaces.
   c. Gypsum board ceilings and soffits.
   d. Metal doors and frames.
   e. Interior steel lintels exposed to view.
   f. Interior stringers, stair pans, handrails and guardrails.
   g. Exterior galvanized handrails.
   h. Exposed to view structural steel.
   i. Exposed to view sprinkler and rain leader piping.
   j. Exposed to view HVAC ducts and piping.
   k. Exposed to view electrical conduit, data cable, and raceways.
   l. Wood interior trim.
   m. Wood fiber (Tectum) wall panels, (including factory primed and finished panels).
   n. Aluminum ceiling cove.
   o. Heat resistant coating for boiler stacks.
   p. Roof top equipment
   q. Exterior galvanized bollards.
   r. Access panels and frames.
   s. Unit masonry assemblies.
   t. Exposed to view suspended ceiling aircraft cable.

2. DO NOT PAINT the following surfaces and materials.
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a. Concealed from view surfaces, except as indicated otherwise in the Contract Documents or as specified herein.
b. Chrome or nickel plating, stainless steel, bronze, brass.
c. Aluminum other than mill finished or factory primed.
d. Factory finished mechanical and electrical equipment, pumps, machinery and similar items which occur in mechanical, storage or equipment rooms or areas.
e. Factory finished materials, specialties, and accessories unless otherwise specified.
f. Ceramic tile, acoustical tile, resilient flooring, wood flooring, and other integrally finished floor, wall and ceiling finishes.
g. Prefinished millwork items.
h. Fire resistant testing and certification labels, code required labels, safety warning labels, performance rating plates, nomenclature plates, identification plates, and similar other labels.

1.3 RELATED SECTIONS.

A. Section 03 30 00 – CAST-IN-PLACE CONCRETE: exposed-to-view concrete foundation walls.
B. Section 04 20 00 – UNIT MASONRY ASSEMBLIES: Concrete masonry partitions.
C. Section 05 12 00 -STRUCTURAL STEEL: Shop priming of structural steel framing.
D. Section 05 50 00 -METAL FABRICATIONS:
   1. Shop priming of designated miscellaneous metals.
   2. Shop priming and shop finishing of designated miscellaneous metal fabrications.
E. Section 06 20 00 - FINISH CARPENTRY: Wood trim items, setting and filling of nails, sanding of wood trim.
F. Section 08 11 13 - STEEL DOORS AND FRAMES: Shop priming of metal frames and steel doors.
G. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
H. Section 09 29 00 - GYPSUM BOARD: Gypsum board partitions, including joint treatment and sanding.
I. Section 10 44 00 – FIRE PROTECTION SPECIALTIES: Shop priming of cabinet doors and frames; shop finishing of cabinet.
J. Divisions 21 and 22: Prefinished items such as plumbing fixtures, sprinkler heads, convectors, anemostates and similar surfaces and materials.
K. Division 26 - ELECTRICAL: Prefinished items such as light fixtures, switch gear, electrical distribution cabinets and similar surfaces and materials.
L. Division 32 – EXTERIOR IMPROVEMENTS: for various site improvements items that call for field painting.
M. Respective sections: Factory-finishing of mechanical, plumbing, fire protection and electrical equipment.
1.4 REFERENCES
A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 20 – REFERENCE STANDARDS AND DEFINITIONS.
   1. ANSI/ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
   3. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.
   4. Steel Structures Painting Council (SSPC): SSPC-SP-1 through 12.
   5. The California Department of health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.

1.5 DEFINITIONS
A. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials specified herein, whether used as prime, intermediate or finish coats.

1.6 SUBMITTALS
A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
   1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
      a. Provide confirmation and data that shows all paints and coatings meet the testing and product requirements of The California Department of health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including the 2004 Addenda.
   2. Samples:
      a. Manufacturer's color selector for custom mixed colors for Architect's color scheduling.
      b. Opaque coatings: Two 9 by 12 inch finished samples on hardboard of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
      c. Transparent finishes and stains: Two 9 by 12 inch finished samples on same species of solid wood and plywood to be furnished under Section 06200 - FINISH CARPENTRY, of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
B. Submit the following under provisions of Section 01 77 00 - CLOSEOUT PROCEDURES:
   1. Color chips: After final approval of all colors and tints by the Architect, submit to the Owner, color chips of all coatings used, with manufacturer's name and mix designation of the coating for the purpose of future re-ordering of coatings. Color chips shall be at least six (6) square inches in size, for each color and tint.
C. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturer’s certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.

3. VOC Content: Submit documentation showing VOC content for all materials submitted.


1.7 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in commercial painting and finishing with 3 years minimum documented experience.

B. Single source responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer and use only within recommended limits.

1.8 FIELD SAMPLES

A. Provide field samples under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying selected colors.

B. Locate samples where directed. The Contractor shall provide in the base Contract, a total amount of samples equal to one sample per room.

C. Accepted samples may not remain as part of the work.

D. Coordination: Review other Specification Sections where primers are provided to ensure compatibility with finish coatings provided under this Section.

E. Mock-ups: The following areas shall require mock-up. Each mock-up area shall be from floor to ceiling and having sufficient coverage to include soffits, columns, and other significant building elements. All specified color for one location shall be applied. Acceptable mock-ups may be incorporated into finish work.

   1. Cafeteria
   2. Library
   3. Corridor
   4. Entry Lobby
   5. Gymnasium
   6. One typical classroom and classroom entry at each floor

F. The mock-up sites shall be in the real location as specified to understand natural light conditions. In addition to natural light, General Contractor shall provide adequate light (equal to finished light source as specified) at each mock-up location for final approval.
1. In the same area, the mock-up sample shall demonstrate the required coverage of the following:
   b. The first coat.
   c. The second coat.
   d. Any applicable subsequent coats.

G. Do not proceed with remaining work until the architect approves the mock-up.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.

B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type fire extinguisher in all areas where materials of this Section are being stored or used.

C. Store paint materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.

D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

1.10 PROJECT CONDITIONS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent unless required otherwise by manufacturer's instructions.

C. Apply paints and finishes above minimum temperature conditions in strict accordance with manufacturer's instructions.

D. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

1.11 SEQUENCING AND SCHEDULING

A. The applicator of work specified herein is responsible to ensure that all paints, enamels, and coatings, proposed to be applied hereunder, are compatible with coatings used for shop-primed items and items which have been prime-coated under the work of other trades.

B. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.
C. Painting work should be scheduled so as to minimize touch-ups. Interior painting is to be without flashmarks. Should flashmarks occur due to touch-ups, the Contractor shall be required to redo the entire surrounding wall surface.

D. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

1.12 EXTRA MATERIALS

A. Provide a minimum of one quart container of trim paints and one gallon container of all other paints and finishes, to the Owner, of each color and finish scheduled herein.

1. Label each container with paint mix number and identify locations where color and tint was used.

1.13 HOISTING EQUIPMENT AND MACHINERY

A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

1. This Sub-Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the work of this section. All such items shall meet the approval of the Owner but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the Associated General Contractors (AGC) and the standards of the State Labor Department.

B. Staging, exterior and interior, required for the execution of the work of this section, shall be furnished, erected, relocated if necessary and removed by this Sub-Contractor. Staging shall be maintained in a safe condition without charge to and for the use of all trades as needed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Interior Paints and general finishes:
   a. Benjamin Moore & Company, Montvale, NJ.
   b. PPG Architectural Finishes, Inc., Pittsburgh, PA.
   c. Sherwin Williams, Cleveland OH.

2. Exterior epoxy finishes and aliphatic acrylic polyurethane finishes.
   a. Tnemec Company Inc., Kansas City, MO.
   b. PPG Industries, Inc., Pittsburgh PA.
   c. International Paint, Houston TX.

3. Cold galvanizing touch-up paint:
   a. Z.R.C. Products Company, Quincy MA.
   b. Duncan Galvanizing, Malden Ma.
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2.2 MATERIALS

A. Coatings: Ready mixed, except for field catalyzed coatings with good flow and brushing properties; capable of drying or curing free of streaks or sags. Color pigments shall be processed to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating. Provide best quality grade, where manufacturer makes more than one grade of any material specified.

B. Liquid zinc coating for touch-up of welds, scratches, and abrasions in galvanized steel: Galvanic Zinc-rich coating containing 95 percent metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter’s Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to FS DOD-P-21035A (formally MIL-P-21035A) for repair of hot-dip galvanizing and meeting the requirements of MIL-P-26915A USAF Specification for Zinc-Rich Paints. Acceptable products include:
   1. Z.R.C. Chemical Products Company, Quincy MA., product: “Z.R.C.”
   2. Duncan Galvanizing, Everett Ma., product: “ZIRP”.

C. Note: If substitutes are proposed, submit complete schedule showing materials specified and equivalent materials proposed as substitutes. Provide complete manufacturers product data on proposed materials. Substitutes must be approved by Architect before commitment for materials is made.

2.3 ACCESSORIES

A. Accessory materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated, but are required to achieve the finishes specified of commercial quality.

B. Sealant for fill of minor cracks in GWB prior to painting, (3 types of GWB – 1. Standard Gypsum Wallboard, 2. ARGB-Abuse Resistant Gypsum Wallboard, 3.-Moisture Resistant Gypsum Wallboard): One component acrylic latex caulking compound, conforming to FS 19-TP-21M and ASTM C 834, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
   2. Tremco, Beachwood OH.; Product – “Acrylic Latex 834”.
   3. Woodmont Products; Product – “Chem-Calk 600”.
   4. Pecora Corporation, Harleysville PA.; Product – “AC-20+”

C. All sealants used under this section shall meet the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile
PART 3 - EXECUTION

3.1 INSPECTION AND GENERAL PREPARATION

A. Inspect surfaces to receive finishes to ensure they are in proper condition to receive work under this Section.

B. If surfaces are not thoroughly dry, or if surfaces cannot be put in proper condition to receive paint or other finish by customary cleaning methods, sanding, or spackling, notify Architect in writing.

C. Commencing work on any surface will be construed as acceptance of the surface as being satisfactory to properly receive the work of this Section.

D. Furnish and lay drop cloths in all rooms and areas where painting and finishing is being done, to adequately protect flooring and other work from all damage during the painting work.

E. Remove hardware, accessories, device plates, lighting fixtures, factory finished work, and similar items; or provide ample in-place protection. Use skilled mechanics for removal, resetting, and protection.

F. Cleaning: Do not paint over dirt, dust, rust, grease, moisture, or other contaminants detrimental to the formation of a durable paint finish. Clean surfaces thoroughly prior to painting in any given area.

G. Touch up bare or abraded spots on surfaces with shop or existing finishes scheduled to be painted under this Section. Use same material used for shop coat. Substrate shall be smooth, free from raised grain; putty sags, cracks, rust, grease, dirt, or other foreign matter or defect.

H. Incompatible Shop Primers: Remove incompatible shop primers and reprime surfaces, or provide barrier coats in compliance with finish paint manufacturer's instructions.

3.2 SURFACE PREPARATION

A. Prepare surfaces to receive work of this Section in strict accordance with manufacturer's instructions applicable to each material, condition, and finish.

B. Gypsum Wallboard: Fill holes, dents, and similar flaws in gypsum wallboard with plaster of Paris or spackling compound. Cut out and fill cracks. Sand surface of patch smooth and flush with adjacent surfaces. Do not abrade adjacent surfaces. Patched areas shall not be detectable in finished work.

C. Plaster: Fill holes, dents, and similar flaws in plaster with plaster of Paris or spackling compound. Cut out and fill cracks. Sand surface of patch smooth and flush with adjacent surfaces. Do not abrade adjacent surfaces. Patched areas shall not be detectable in finished work.

   1. Plaster Moisture Test: Before painting new plaster, test surfaces with a moisture detecting device, such as Kaydel Plaster Test, Type CP-48, manufactured by Hard Moisture Gauges, Inc. Do not apply sealer or paint when moisture content of plaster exceeds 8%. Perform testing in presence of Architect and in as many locations as directed. Dry-brush plaster thoroughly prior to painting or sealing.

D. Concrete and Masonry: Prepare concrete and masonry surfaces prior to painting. Allow a minimum of 60 to 90 days curing time prior to painting poured or precast concrete.
Allow a minimum of 30 to 60 days curing time prior to painting concrete masonry. Determine substrate alkalinity and moisture content and take appropriate remedial actions as recommended by paint material manufacturer. Do not paint surfaces which are sufficiently alkaline to cause blistering or peeling until remedial action is taken. Do not paint surfaces where moisture content exceeds that permitted in manufacturer’s printed instructions.

1. Thoroughly clean of dirt, grit, loose materials, mortar drippings, and other deleterious substances.
2. Concrete floor which is to receive sealer shall be thoroughly washed with a cleaning and degreasing solution, in accordance with the recommendations of the sealer manufacturer.
3. The first coat for masonry is a fill coat. Thoroughly brush fill coat into the surface in accordance with manufacturers directions. Preliminary coats on masonry are to be absorbed into the surface. Provide additional undercoats as necessary to achieve perfect uniformity of finish coats.

E. Wood to be Painted: Sand surfaces smooth and free of marks prior to applying first coat. Wash sap spots and knots with mineral spirits. When dry, touch-up spots and knots with an approved sealer for exterior work, and with two coats of shellac for interior work.

1. Fill nail holes, cracks, open joints, and other defects, with puffy or plastic wood filler. Sand smooth when dry.
2. Prime tops, edges, and bottoms, of unprimed wood doors immediately upon delivery. Prime hardware cut-outs in similar manner prior to installation of butts, locks, and closers.
3. Prime wood edges, ends, faces, undersides, backsides, including cabinets, casework, paneling, and moldings and trim.
4. Prime wood glazing rabbets and sealant slots before glazing or sealant work is begun.

F. Field-Welded Ferrous Metal: After installation, field-welding, and grinding, and immediately before painting, remove rust, loose mill scale, dirt, weld flux, weld spatter, weld smoke stains, burnt primer, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP 3. Remove grease and oil by use of solvent recommended by paint manufacturer. Sand exposed surfaces, and between coats, as required to produce smooth, even finishes.

1. Sand smooth and spot prime welded areas, and areas where prime coat has been damaged or abraded, using rust inhibitive primer scheduled in this Section.

G. New Other Ferrous Metal: Remove rust, mill scale, and foreign materials. Wire brush or sand damaged or rusted area to bright metal. Remove grease or dirt with solvents recommended by paint manufacturer just prior to applying paint.

1. Spot prime all areas where shop coat has been damaged or abraded, using same type paint as used for shop coat.

H. Field-Welded Galvanized Metal: After installation, field-welding, and grinding, and immediately before painting, remove rust, loose mill scale, dirt, weld flux, weld spatter, weld smoke stains, and other foreign material with wire brushes and/or steel scrapers. Power tool clean in accordance with SSPC SP 3. Remove grease and oil with solvents recommended by paint manufacturer. Sand exposed surfaces, and between coats, as required to produce smooth, even finishes.

1. Sand smooth welded areas, and areas where galvanized coating has been damaged or abraded. Spot prime using zinc primer scheduled in this Section.
I. Other Galvanized Metal: Prior to installation, remove corrosion and foreign materials by sanding or other appropriate method. Remove grease or dirt with solvent recommended by paint manufacturer just prior to applying primer.

J. Other Non-Ferrous Metal: Prepare shop primed non-ferrous metals similarly to ferrous metals, specified above.
   1. Prepare unprimed non-ferrous metals by thoroughly cleaning of oil, grease, and temporary protective coatings using solvent recommended by primer manufacturer. Provide additional pretreatment recommended by primer manufacturer to assure permanent adhesion of paint coats.

K. Other Materials: Prepare other materials in strict accordance with recommendations of manufacturers of materials to be finished, and primers and finishes to be applied.

L. Materials Preparation: Mix and prepare paint materials in accordance with manufacturer's printed instructions. Use only thinners approved by paint manufacturer, and only within recommended limits.

3.3 APPLICATION.

A. Painting Schedule in this Section lists minimum number of coats required. If specified minimum number of coats does not completely cover or hide base materials, provide additional coats required for coverage and uniform finish appearance, as determined by Architect, without additional cost to Owner.

B. Apply paint in strict accordance with manufacturer's instructions. Use applicators and techniques best suited for substrates and types of materials being applied. No material shall be thinned in any way except as directed by manufacturer.

C. Apply paints and coatings at coverage rates and dry film thicknesses scheduled at the end of this Section. Each coat applied must be inspected and approved by Architect prior to application of succeeding coat, otherwise no credit for the coat applied will be given and work in question shall be recoated without additional expense to Owner. Notify Architect when each coat is ready for inspection.

D. Additional Coats: Provide additional coats necessary to eliminate show through and bleed through conditions.

E. Drying Time: Allow manufacturer's recommended drying time between successive coats. However, allow each coat to thoroughly dry prior to application of subsequent coat.

F. Sanding: Lightly sand finishes between coats using #00 sandpaper.

G. Tinting: Tint prime coat on gypsum wallboard and plaster to approximate color of final shade.

H. Closets: Finish closets inside the same as adjoining rooms, unless otherwise specified or scheduled.

I. Painted Doors and Panels: Paint doors, panels, access panels, etc., in the "open" position. Paint all edges, tops, bottoms, and both faces. Paint back face of access panels and removable or hinged covers to match adjacent exposed surfaces.

J. Movable Equipment and Furnishings: Paint surfaces behind movable equipment and furnishings same as adjacent exposed surfaces.

K. Permanently Fixed Equipment: Paint surfaces behind permanently fixed equipment with prime coat only.
L. Duct Interiors: Paint interior surfaces of ducts where visible through registers, grilles, or louvers with flat black, non-specular paint.

M. Finished work shall be free from runs, sags, hairs, defective brushing, and clogging of lines and angles. Flaws visible in the completed work shall be removed and the area satisfactorily repaired.

N. Mechanical and Electrical Work: Painting of mechanical and electrical items is limited to items other than factory-finished and exposed to view in the mechanical rooms and in occupied areas and at roof tops.
   1. Mechanical items to be painted include, but are not limited to:
      a. Ductwork.
      b. Heat exchangers.
      c. Insulation
      d. Motors and mechanical equipment.
      e. Piping, hangers, and supports.
      f. Tanks and equipment.
   2. Electrical items to be painted include but are not limited to:
      a. Conduit and fittings.
      b. Switchgear.

O. Block Fillers: Apply block fillers to concrete masonry units at rates to ensure complete coverage with pores completely filled.

P. Completed Work: Provide finishes that match approved samples and mock-ups for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 COMPLETION

A. Cleaning: At completion of work of this Section, remove paint and varnish spots, and oil, grease, and other stains caused by this work from exposed surfaces. Leave finishes in a satisfactory condition.

B. At completion of work of this Section, remove masking materials and other debris. Reinstall or replace fixtures, plates, etc., removed to facilitate application of paint.

C. Retouching: Touch-up and repair applied finishes which, for any reason have been damaged during construction work. All finished work applied under this Section shall have finished surfaces as approved by finish material manufacturer.

D. Final Inspection: Protect painted surfaces against damage until date of Substantial Completion. Architect will conduct final inspection of painting work. Areas that do not comply with requirements of these Specifications shall be repainted or retouched to satisfaction of Architect at no additional cost to Owner.

3.5 CLEANING

A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.
3.6 PROTECTION AND TOUCH-UP

A. During painting work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.

B. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final review of all work performed hereunder. Re-coat or touch-up, all scratches and other blemishes on surfaces, and as directed by the Architect, any areas found which do not comply with the requirements of this Section, and bear all costs thereof.

C. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.

3.7 TRASH AND DEBRIS REMOVAL

A. The General Contractor will provide dumpsters for use by all subcontractors under SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS. During the course of the work, at the end of each workday, subcontractors shall clean up trash and debris caused by their work, and deposit them in the dumpsters, or, at the subcontractor’s option, haul it away and dispose of off-site legally.

3.8 PAINTING SCHEDULE – GENERAL FINISHES AND COLORS

A. General: Number of coats scheduled herein below is minimum required, refer to Article entitled “APPLICATION” regarding coverage.

B. The Architect will furnish a schedule of colors for each area and surface. Tinting and matching shall be to the satisfaction of the Architect. No limit is placed on the number of colors that may be required, or the colors selected in any one room, area, or surface. Premium paints of deep-hued, bright, pigment intensive, accent and primary colors may be scheduled for up to 25 percent of all interior and exterior surfaces without additional cost to the Owner.

C. The Architect shall select the following number of colors for interior spaces:
   1. Paint color schedule for Instrumental, Choral and Practice Music Rooms
      a. 2 wall colors.
      b. 1 soffit colors.
      c. 1 color door frame.
   2. Paint color schedule for Cafeteria
      a. 4 wall colors
      b. 2 soffit colors
      c. 1 door frame
      d. 1 ceiling / underside of deck
   3. Paint color schedule for Kitchen/ Servery Area
      a. 2 wall colors.
      b. 1 soffit colors
      c. 1 door frame
   4. Paint color schedule for Storage Rooms:
      a. 1 wall color.
      b. 1 color for ceiling / underside of deck, structure steel members and ducts.

D. All prime and intermediate coats shall be tinted on interior colors.
E. Colorants shall be pure, non-fading pigments, mildew-proof, ultra-violet resistant, finely ground in approved medium; and be lime proof, when used in coatings to be applied on masonry, concrete, plaster, and gypsum board surfaces.

F. Number of coats scheduled is minimum requirement. Additional coats may be required to achieve the desired result.

3.9 EXTERIOR PAINTING SCHEDULE

A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.

B. Exterior METAL - Ferrous, bare metal and shop primed, including existing Mechanical, Electrical, and similar equipment:
   1. Surface Preparation: SSPC-SP16.
   2. One coat rust inhibitive primer. (touch up bare metal at shop primed surfaces)
      a. Tnemec 90G-1K97 at 3 mils DFT.
   3. One coat protective coating:
      a. Tnemec V69 Hi-Build Epoxoline at 3.0 mils DFT.
   4. One coat acrylic gloss enamel:
      a. Tnemec 1095 Endura-Shield at 3.0 mils DFT.

C. Exterior METAL - Galvanized (other than shop finished handrails):
   2. One coat primer:
      a. Tnemec V69 Hi-Build Epoxoline at 3.0 mils DFT.
   3. One coat acrylic gloss enamel:
      a. Tnemec 1095 Endura-Shield at 3.0 mils DFT.

D. Exterior METAL - Aluminum (where required), Painted Finish:
   1. Surface Preparation: Pressure wash with Oakite and sand with 3M Scotch-Brite nylon pads.
   2. One coat primer:
      a. Tnemec V69 Hi-Build Epoxoline at 3.0 mils DFT.
   3. One coat acrylic gloss enamel:
      a. Tnemec 1095 Endura-Shield at 3.0 mils DFT.

3.10 INTERIOR PAINTING SCHEDULE

A. Interior CONCRETE AND MASONRY walls and partitions, scheduled to receive latex paint finish:
   1. Eggshell Finish:
      a. 1st Coat: BM Ultra Spec Masonry Int/Ext 100% Acrylic Block Filler #571
      b. 2nd Coat: BM Ultra Spec HP DTM Acrylic Enamel Low Luster #HP25
      c. 3rd Coat: BM Ultra Spec HP DTM Acrylic Enamel Low Luster #HP25 (2.3 mils dry per coat).
   2. Semi-Gloss Finish:
      a. 1st Coat: BM Ultra Spec Masonry Int/Ext 100% Acrylic Block Filler #571.
c. 3rd Coat: BM Ultra Spec DTM Acrylic Enamel Semi-Gloss #HP 29 (2.3 mils dry per coat).

B. Interior CONCRETE AND MASONRY walls and partitions scheduled to receive epoxy paint (designation EP), and CONCRETE MASONRY walls and partitions scheduled to receive epoxy paint finish:
   1. Eggshell Finish:
      a. 1st Coat: BM Ultra Spec Masonry Int/Ext 100% Acrylic Block Filler #571.
      b. 2nd Coat: BM Corotech Pre-Catalyzed Epoxy Eggshell #V342
      c. 3rd Coat: BM Corotech Pre-Catalyzed Epoxy Eggshell #V342 (1.6 Mils dry per coat).

   2. Semi-Gloss Finish:
      a. 1st Coat: BM Ultra Spec Masonry Int/Ext 100% Acrylic Block Filler #571.
      b. 2nd Coat: BM Corotech Pre-Catalyzed Epoxy Semi-Gloss #V341.
      c. 3rd Coat: BM Corotech Pre-Catalyzed Epoxy Semi-Gloss #V341 (1.7 Mils dry per coat).

C. Interior GYPSUM BOARD (drywall) partitions, scheduled to receive latex paint finish:
   1. Eggshell Finish:
      a. 1st Coat: BM Ultra Spec 500 Interior Primer #N534 (1.8 mils dry).
      b. 2nd Coat: BM Ultra Spec 500 Low Sheen Eggshell #N537.
      c. 3rd Coat: BM Ultra Spec 500 Low Sheen Eggshell #N537 (1.8 Mils dry per coat).

   2. Semi-Gloss Finish:
      a. 1st Coat: BM Ultra Spec 500 Interior Primer #N534 (1.8 mils dry).
      c. 3rd Coat: BM Ultra Spec 500 Low Sheen Semi-Gloss #N539 (1.8 Mils dry per coat).

D. Interior GYPSUM BOARD (drywall) partitions, scheduled to receive epoxy paint finish:
   1. Eggshell Finish:
      a. 1st Coat: BM Ultra Spec 500 Interior Primer #N534 (1.8 mils dry).
      b. 2nd Coat: BM Corotech Pre-Catalyzed Epoxy Eggshell #V342.
      c. 3rd Coat: BM Corotech Pre-Catalyzed Epoxy Eggshell #V342 (1.6 Mils dry per coat).

   2. Semi-Gloss Finish:
      a. 1st Coat: BM Ultra Spec 500 0 VOC Interior Primer #N534 (1.8 mils dry).
      b. 2nd Coat: BM Corotech Pre-Catalyzed Epoxy Semi-Gloss #V341.
      c. 3rd Coat: BM Corotech Pre-Catalyzed Epoxy Semi-Gloss #V341 (1.7 Mils dry per coat).

E. Interior GYPSUM BOARD (drywall) ceilings, and underside of soffits scheduled to receive latex paint finish:
   1. Flatt Finish:
      a. 1st Coat: BM Ultra Spec 500 Interior Primer #N534 (1.8 mils dry).
      b. 2nd Coat: BM Ultra Spec 500 Low Sheen Eggshell #N537.
c. 3rd Coat: BM Ultra Spec 500 Low Sheen Eggshell #N537 (1.8 Mils dry per coat).

F. Interior GYPSUM BOARD (drywall) soffits in cafeteria areas for epoxy finish
   1. Eggshell Finish:
      a. 1st Coat: BM Ultra Spec 500 Interior Primer #N534 (1.8 mls dry).
      b. 2nd Coat: BM Corotech Pre-Catalyzed Epoxy Eggshell #V342.
      c. 3rd Coat: BM Corotech Pre-Catalyzed Epoxy Eggshell #V342 (1.6 Mils dry per coat).

G. Interior METAL – Aluminum galvanized
   1. Semi-Gloss Finish:
      a. 1st Coat: BM Super Spec HP Acrylic Metal Primer #P04 (2.1 mils dry).
      b. 2nd Coat: BM Ultra Spec HP DTM Acrylic Semi-Gloss #HP 29
      c. 3rd Coat: BM Ultra Spec HP DTM Acrylic Semi-Gloss #HP 29 (2.3 mils dry per coat).

H. Interior METAL – Galvanized Ceilings, Duct work
   1. Egg-Shel Finish Dryfall Waterborne Topcoats:
      a. 1st Coat: BM Latex Dry Fall Eggshell #0396.
      b. 2nd Coat: BM Latex Dry Fall Eggshell #0396 (1.4 mls dry per coat).

I. Interior METAL - Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal, scheduled to receive latex paint finish:
   1. Egg-Shel / Satin Finish:
      a. 1st Coat: BM Super Spec HP Acrylic Metal Primer #P04 (2.1 mils dry).
      b. 2nd Coat: BM Ultra Spec HP DTM Acrylic Enamel Low Luster #HP25
c. 3rd Coat: BM Ultra Spec HP DTM Acrylic Enamel Low Luster #HP25 (2.3 mils dry per coat).
   2. Semi-Gloss Finish:
      a. 1st Coat: BM Super Spec HP Acrylic Metal Primer #P04 (2.1 mils dry).
      b. 2nd Coat: BM Ultra Spec HP DTM Acrylic Semi-Gloss #HP 29
      c. 3rd Coat: BM Ultra Spec HP DTM Acrylic Semi-Gloss #HP 29 (2.3 mils dry per coat).

J. Interior METAL - Aluminum, shop primed to receive- semi-gloss finish:
   1. Semi-Gloss Finish:
      a. 1st Coat: BM Super Spec HP Acrylic Metal Primer #P04 (2.1 mils dry).
      b. 2nd Coat: BM Ultra Spec HP DTM Acrylic Semi-Gloss #HP 29
      c. 3rd Coat: BM Ultra Spec HP DTM Acrylic Semi-Gloss #HP 29 (2.3 mils dry per coat).

K. Interior WOOD – Walls, Ceiling, Doors, Trim:
   1. Latex System:
      a. Semi-Gloss Finish:
         1) 1st Coat: BM Sure Seal Primer #0027 (1.3 mils dry).
         2) 2nd Coat: BM Ultra Spec 500 Semi-Gloss #N539
         3) 3rd Coat: BM Ultra Spec 500 Semi-Gloss #N539 (1.8 mils dry per coat).
2. Stain and Varnish System  
   a. Satin Finish:  
      1) 1st Coat: BM Lenmar Waterborne Interior Wiping Stain 1WB1300.  
      2) 2nd Coat: BM Lenmar Aqua-Plastic Urethane Clear Satin C1WB.1427  
      3) 3rd Coat: BM Lenmar Aqua-Plastic Urethane Clear Satin C1WB.1427 (1.1 mils dry).  

L. Interior TECTUM WALL PANELS (non fabric type)  
   1. Egg-Shel / Satin Finish:  
      a. 1st Coat: BM Super Spec Interior Latex Egg-Shel (1.2 mils dry).  
      b. 2nd Coat: BM Super Spec Interior Latex Egg-Shel  
      c. 3rd Coat: BM Super Spec Interior Latex Egg-Shel (1.2 mils dry per coat).  

3.11 PAINTING SCHEDULE FOR MECHANICAL AND ELECTRICAL EQUIPMENT  

A. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that 
   are visible through grilles and louvers with one coat of flat black enamel.  
   1. Paint dampers exposed behind louvers, grilles, and convector and baseboard 
      cabinets to match face panels.  
   2. Remove unfinished louvers, grilles, covers and access panels on and paint as 
      scheduled above.  

B. Plywood backboards for electrical panels and other equipment. Paint both front and back 
   surfaces and all edges of plywood backboards before backboards are installed.  
   1. Two coats of paint to seal boards and prevent moisture penetration 
      c. ICI-Dulux Paints: Lifemaster #9200, Water Borne Acrylic  

C. Prime and paint insulated and exposed cold pipes, conduit, electrical boxes, insulated 
   and exposed ducts, hangers, brackets, collars and supports, except where items are 
   located in storage, mechanical or equipment spaces or those items which are factory 
   prefinished.  

D. Exposed to view un-insulated hot pipes within finished painted areas: Two coats heat-
   resistant enamel conforming to Federal Specification TT-E-496, Type I, applied when 
   surfaces are less than 140 degrees Fahrenheit.  

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

1.2 SUMMARY
A. Provide labor, materials and equipment necessary to complete wall and corner guard work as indicated on the Drawings. Work shall include, but not be limited to, the following:

1. Stainless Steel Wall Panels at Kitchen.
2. Corner guards at all exterior corners in corridors and lobbies in gypsum wallboard construction.

1.3 RELATED SECTIONS
A. Section 09 29 00 – GYPSUM BOARD.

1.4 PERFORMANCE REQUIREMENTS
A. Corner guards to resist lateral impact force of 100 pounds at any point without damage.

1.5 SUBMITTALS
A. Submit the following under the provisions of Section 01 33 00 – SUBMITTAL PROCEDURES:

1. Literature: Manufacturer’s product data sheets, specifications for each item furnished hereunder.

2. Installation instructions: Indicate installation rough-in measurements and instructions.

B. High Performance Buildings Compliance Submittal: Submit the required documents in accordance with the Checklist as a separate submittal package to Construction Manager’s High Performance Buildings Compliance Coordinator, including information on each product specified:

1. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery of raw materials used in the products manufacturing; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; include distance between manufacturing facility and the project site.

2. Recycled content: Manufacturer’s certification of recycled content indicating percentage by weight of both pre-consumer and post-consumer recycled content.
3. VOC Content: Submit documentation showing VOC content for all materials submitted.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier.

B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, and damage from construction traffic and other causes.

1.7 PROJECT CONDITION

A. Environmental Requirements: Products must be installed in an interior climate controlled environment.

PART 2 - PRODUCTS

2.1 STAINLESS STEEL WALL PANELS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. InPro Corp.
   2. Koroseal Wall Protection System
   3. Construction Specialties, Inc.

B. Basis of Design: Stainless Steel Wall Panels by InPro Corp.
   1. Provide stainless steel wall panel systems that include panels, top cap, divider trim, inside and outside corner trim.
   2. Panel Size – Custom, Maximum 4’ x 10’
   3. Panel Thickness - 18 gauge Stainless Steel - Type 304
   4. Stainless Steel Inside and Outside Corner Trim:
      a. 1” (25mm) x 1” (25mm), 24 gauge. 120” (3048mm) Height. Receives edge of adjacent panel.
         1) Stainless Steel - Type 304
         2) Attachment: Adhesive mount
   5. Stainless Steel Top Cap:
      a. 1” (25mm) x 1” (25mm), 24 gauge. 120” (3048mm) Height. Receives edge panels.
         1) Stainless Steel - Type 304
         2) Attachment: Adhesive mount
   6. Stainless Steel Divider Trim:
      a. 1” (25mm) x 1” (25mm), 24 gauge. 120” (3048mm) Height. Receives edge of adjacent panel.
         1) Stainless Steel - Type 304
         2) Attachment: Adhesive mount
   7. Attachment:
      a. Panel: Panels shall be adhered with field applied heavy duty adhesive and foam tape.
      b. Trim Pieces: Trim pieces shall be adhered with field applied heavy duty adhesive.
   8. Finish: Panels and corner guards shall have a No. 4 satin finish.
2.2 CORNER GUARDS

A. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
   1. InPro Corp.
   2. Koroseal Wall Protection System
   3. Construction Specialties, Inc.

B. Basis of design: BluNose High Impact Corner Guard by InPro Corp.
   1. Vinyl Covers: Snap on cover of .080" (2mm) thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).
   2. Vinyl Retainers: Continuous vinyl retainers of .070" (1.8mm) thickness with a co-extruded flexible vinyl apex shall be fabricated from polyvinyl chloride with the addition of impact modifiers.
   3. Components:
      a. Top caps and bottom caps shall be made of injection molded thermoplastics.
      b. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.
      c. Flexible top caps shall be made of injection molded flexible PVC.
   4. Color: Colors of the corner guard to be selected by the Architect from the Manufacturer’s full range of standard finish selection. Surface shall have a pebblette texture.
      a. Molded Components: Top caps and bottom caps shall be of a color matching the corner guards. Surface shall have a pebblette texture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Wall surface shall be dry and free from dirt, grease and loose paint.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

3.3 INSTALLATION
A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Stainless Steel Wall Panel Installation: Locate the wall panels as indicated on the approved detail drawing for the appropriate substrate and in compliance with the manufacturer’s installation instructions. Install wall panels level and plumb at the height indicated on the drawings. Complete installation with inside and outside corners.

2. Corner Guards Installation:
   
a. Position the vinyl retainer against the wall, allowing 5/16" (8mm) from the bottom of the retainer to the top of the cove base or baseboard for the bottom cap.

b. Secure the retainer to the wall using #8 x 1-1/4" Phillips round head, self-tapping screws. Stagger the fasteners on each wing of the retainer. Use 4 screws per 3' (.91m) length, 6 screws per 4' (1.22m) length, 10 screws per 8' (2.44m) length, or 12 screws per 9' (2.74m) length.

c. Top and Bottom Cap Installation: Overlap the retainer with the mounting tabs of the top and bottom caps and attach them to the retainer using two, #8 x 1-1/4" phillips flat head, self tapping screws per cap. Stagger the fasteners on each wing of the cap. Provide mounting hardware, anchors, and other accessories required for a complete installation.

d. Position the vinyl cover on the retainer to check the fit. Adjust the top cap on the retainer to obtain a tight fit with the vinyl cover. Starting at the top, push the vinyl cover over the retainer pressing over the entire length until the cover snaps securely into place.

e. Vinyl retainers shall be flexible for field bent to angles 10° wider or 10° tighter than 90°. When doing so use flexible top and bottom caps or the installation should be full height from floor to ceiling.

3.4 CLEANING

A. Immediately after completion of installation, clean surface in accordance with the manufacturers clean up and maintenance instructions.

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Public and staff use washroom accessories.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.
   2. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.
1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.


F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.


2.2 PUBLIC AND STAFF USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products based on the Bobrick Washroom Equipment, Inc. product model number listed:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.

B. Toilet Tissue (Roll) Dispenser Supplied by Owner, installed by Contractor.

C. Liquid-Soap Dispenser Supplied by Owner, installed by Contractor.

D. Grab Bars (For Two Toilet Rooms):
   3. Material: Stainless steel, 0.05 inch thick.
a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

4. Two sets required for new restrooms.


6. Configuration and Length: As indicated on Drawings.

E. Paper Towel Dispenser furnished by Owner installed by Contractor.

F. Mirror Unit (Two Required):


2. Frame: Stainless-steel channel.
   a. Corners: Mitered and mechanically interlocked.

   a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

4. Size: 18 x 36" H.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446. Remove and reinstall one set of existing grab bars in existing Men's Room.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

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SECTION 11 40 00
FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Sections, apply to this Section.

1.2 SCOPE

A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer’s standards and are required for this project.

B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.

C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.

D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.

E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.

F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.

1. Work in this Section shall include but shall not be limited to the following:
2. Catalog items of equipment.
3. Fabricated equipment other than catalog items.
4. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
5. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.

B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.

C. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.

D. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.4 SUBMITTALS

A. Submit Shop Drawings for approval in accordance with the General Conditions.

B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.
   1. Hand drawn scale: 1/2 inch = 1'-0".
   2. CAD drawn scale: 1/4 inch = 1'-0".
   3. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
   4. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
   5. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
   6. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned

C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.
D. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.

E. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.

F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.

G. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.

1.5 SAMPLES

A. If the bidder's proposed equipment fabricator is unknown to the Consultant's office, immediately after award of contract, submit the following samples for selection and approval:
   1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
   2. Drawer assembly (will be returned for use on this project).

B. Work delivered to the job shall match approved samples.

1.6 GUARANTEES AND WARRANTIES

A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.

B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is required, the Owner will have the option of full use of the defective equipment until a replacement has been delivered and completely installed.

C. Furnish manufacturer's warranties for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the
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Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.7 REGULATORY AGENCIES

A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.

B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.

C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).

D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).

E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.

F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.

1.8 EQUALITY OF MATERIALS AND EQUIPMENT

A. The base bid shall contain no substitutions to these drawings or specifications. Bidders may offer substitute equipment in a separate proposal, indicating the proposed model and sum to be added or deducted if the alternate item is accepted by the Owner. Each line item shall include delivery, installation and taxes. Decisions to accept or reject a piece of equipment shall be made by the Owner, and all decisions shall be final.

PART 2 - PRODUCTS

2.1 MATERIALS AND FINISHES

A. General

1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.

2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.

B. Stainless Steel

1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.
C. **Galvanized (Galvannealed) Steel**
   1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.

D. **Plastic Laminate Materials**
   1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
   2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer’s specifications.
   3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
   4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
   5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

### 2.2 CONSTRUCTION

A. **General**
   1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
   2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
   3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
   4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. **Welding**
   1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the
exposed parts ground smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.

2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.

3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grind, Polish and Finishing

1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.

2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.

3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.

4. Excessive distortion caused by welding shall be a cause for rejection for that item of equipment.

2.3 BUY-OUT COMPONENTS

A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal by Kason, or PDI Atlanta.

B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal by Kason, or PDI Atlanta.
C. **DOOR AND DRAWER PULLS**: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal by Kason, or PDI Atlanta.

D. **DOOR HINGES**: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002 or equal by Kason, or PDI Atlanta.

E. **DRAWER PANS**: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal by Kason, or PDI Atlanta.

F. **DRAWER SLIDES**: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal by Kason, or PDI Atlanta.

G. **FAUCET SETS, DECK MOUNTED**: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on swivel nozzle or swivel gooseneck to suit the application; T&S Brass B-0221 or B-0321, or equal by Component Hardware, Chicago, or Fisher.

H. **FAUCET SETS, POTWASHING SINK**: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-0290 or equal by Component Hardware, Chicago, or Fisher.

I. **FAUCET SETS, SPLASH MOUNTED**: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231-CC or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.

J. **GUSSETS**: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal by Kason, or PDI Atlanta.

K. **LEG AND BULLET FOOT ASSEMBLIES**: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal by Kason, or PDI Atlanta.

L. **LEG AND FLANGED FOOT ASSEMBLIES**: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal by Kason, or PDI Atlanta.

M. **NUTS**: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal by Kason, or PDI Atlanta.

N. **SEALANT**: Sealant for sealing equipment to walls or filling crevices between components. All materials listed below that are used in the building interior must not exceed the following requirements:

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1. South Coast Air Quality Management District (SCAQMD) Rule #1168
2. For interior adhesives and sealants applied within the weatherproof barrier, submit a printed statement of VOC content.

O. SOUND DEADENING BASINS: Component Hardware Q75-1366 or equal by Kason, or PDI Atlanta.

P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225, or equal by Kason, or PDI Atlanta, "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.

Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal by Kason, or PDI Atlanta.

R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000 or equal by Component Hardware, Chicago, or Fisher.

S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal by Kason, or PDI Atlanta.

T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.

2.4 FABRICATED COMPONENTS

A. Box Type Cabinet Construction
   1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
   2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
   3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in. welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards
   1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not
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be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.

2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.

3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails

1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly

1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.

2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.

3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.

4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges

1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.

2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.

3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
4. Short (6 inch) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.

5. Tall (10 inch) splash on preparation sinks, dishtables, counter, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.

6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves

1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvanized steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.

2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.

3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors

1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.

2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof
louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts
1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Sliding Doors
1. Sliding doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle. Provide sliding doors with nylon roller bearing sheaves and overhead track components equal to Component Hardware B58-5523 and 5513 sheaves, B57 track, B62-1093 nylon door guides and B60-1086 door stops.

J. Undershelves
1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

K. Wall Brackets
1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in. wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.
2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.
L. Wall Shelves
   1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.5 ELECTRICAL EQUIPMENT AND WIRING

A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.

B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.

C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter’s Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.

D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.6 ITEM SPECIFICATIONS

Item 1
MOP SINK & FAUCET
No work in this Section. Item to be provided and installed by Plumbing Contractor.

Item 2
UTILITY SHELF
Make- Advance Tabco K-246*C166 or equal
Size- 36” x 8” x 7-1/2” high
Description - Unit shall be all standard construction of welded 18 gauge stainless steel type 430 polished satin finish, back and sides turned up 1-1/2”, mounted on two die formed wall brackets and furnished with three mop hangers and four rag hooks.

Item 3
MOP BUCKET
No work in this Section. Item to be provided by Owner.
Item 4
DETERGENT STORAGE CABINET
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 36 in. by 18 in. by 72 in. high
Construction - 16 gauge stainless steel sloped top at 104 degrees with edges turned down, 18 gauge stainless steel cabinet body, fixed bottom shelf, three adjustable intermediate shelves, and 63 in. high double pan hinged doors at front. Mount on 6 in. high stainless steel adjustable legs. Secure unit to wall and seal as required.
Accessories - Provide unit with two (2) three point "T" handles, one locking and barrel bolts mounted to inside top and bottom of door.

Item 5
FRONT LOAD CLOTHES DRYER
Make - UniMac UDEE5BG5173CW01 or equal Wascomat or Speed Queen
Size - 27" x 28" x 40-1/2" high
Power - 30 amps circuit - 120/240/60/1 - cord and plug
Description - Dryer shall be all standard front loading construction with white exterior, 7 cubic foot capacity, galvanized drum, electronic controls, lint filter, and interior light.

Item 6
FRONT LOAD CLOTHES WASHER
Make - UniMac UFNE5BP115TW01 or equal Wascomat or Speed Queen
Size - 27" x 27-3/4" x 40-1/2" high
Power - 20 amps circuit - 120/60/1 - cord and plug
Water factor - 3.7 gallons/ft3/cycle
Certification - Unit shall be Energy Star compliant and CEE qualified.
Description - Washer shall be all standard front loading construction with white exterior, see-thru door with heavy duty stainless steel hinge, 3.42 cubic foot front loading stainless steel basket, detergent dispensers, electronic controls, three wash/rinse temperatures, and five selectable wash cycles.

Item 7
LOCKERS
Quantity - 6
No work in this Section. Item to be provided and installed by General Contractor.

Item 8
STAINLESS STEEL CORNER GUARD
Quantity - 27
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 4" x 4" x 48" high
Description - Fabricate from 14 gauge 304 stainless steel, break long edges so that guards “hug” the wall when installed. KEC to field verify angle prior to fabrication. Secure with suitable adhesive and six maximum stainless steel fasteners per unit
Item 9
No item

Item 10
WALK-IN COOLER
Make - American Panel or equal by Bally or Imperial Brown
Size - 9'-1-1/2" x 9'-11-1/2" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor
Power - 1.1 KW - 120/60/1 to light fixtures, temperature monitor/alarm, and door defrost heater strip
Installation, Construction, Materials and Accessories - See Item 11
Guarantee - See Item 11

Item 11
WALK-IN FREEZER
Make - American Panel or equal by Bally or Imperial Brown
Size - 9'-1-1/2" x 9'-11-1/2" x 7'-10" high minimum inside dimensions; 7'-8" high after finished floor is installed by the General Contractor
Power - 1.3 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port
Installation - The walk-in refrigerated room shall be installed in a 7" deep ID recess (below finished floor). Recess depth allows 1" for use of leveling sand; 4" for the insulated floor panels; 2" for finished floor and setting bed that shall be carried in from the adjacent room and level to same. The finished floor and setting bed shall be furnished and installed by the General Contractor, and shall have coved joints at all walls, turned up a minimum of 4" inside and out. The unit shall be set level on a bed of clean, dry mason's sand. Shims are not acceptable for leveling material.
Construction - All standard construction per the manufacturer, modified to meet the specific following points:
- Walls to be 4" thick with CFC free urethane foam insulation, UL Class 1 rated
- Cam type locking devices
- 34" x 80" minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1806 LED light fixtures or Kason 1808 LED light fixtures
- Dial type thermometers at doors
- Model IC+ temperature and HACCP monitoring system at doors. Cooler and freezer alarms to interconnect with access control system for alert monitoring. Each system to be provided with a pair of 22 gauge low voltage wires. Wires shall be installed by the Controls Contractor. Wires shall run from the dry contacts to the access control panel. Kitchen Equipment Contractor to verify length prior to purchasing. To avoid false triggering, provide a shielded two-conductor cable with the shield connected to the receiving equipment.
- NSF construction throughout with exception of buried floor panels
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- Interior and exterior faces of doors and exposed exterior walls shall be provided with aluminum diamond tread plate protective material to a height of 48” above finished floor. Hold diamond plating up 6” from the finish floor to accommodate the coved base.

Minimum materials - Interior and exterior wall surfaces shall be clad with .038” pebble finished aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor shall be 14 gauge galvanized steel.

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Each door shall be provided with a heated vision panel, 14-1/2” x 23” constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide matching trim strips and closure panels to adjoining surfaces, fabricated per details, made of largest pieces available to minimize number of joints, and installed in accordance with NSF Brochure 770202, Installation Manual for Walk-in Refrigerators and Freezers. Provide eight total extra Kason 1806 LED OR Kason 1808 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Item 12
MECHANICAL REFRIGERATION SYSTEM
Quantity - 2
Make - Heatcraft, Bohn, Larkin, Climate Control, Chandler
Scope - Furnish and install complete refrigeration systems for the walk-in refrigerated rooms in accordance with the plans. The systems shall include condensing units, evaporator coils, piping, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted refrigeration practice.

Important: The installation work shall be performed by a fully qualified refrigeration contractor employing a certified mechanic fully trained in the installation of commercial refrigeration systems. Submittal shall list the installing company and the qualified system installer.

Piping - Furnish and install the interconnecting piping between the condensing units and their respective unit coolers. Piping shall be installed in a neat and workmanlike manner with adjustable hangers spaced at no more than ten foot intervals on horizontal runs; six foot intervals, vertical runs.

Line sizes shall be in accordance with ASHRAE standards and best refrigeration practice to assure proper feed to evaporator, avoid excessive pressure drop, and prevent excessive amounts of lubricating oil from being trapped in any part of the system. Line sizing shall be such that it will protect the compressor from loss of lubrication at all times, prevent liquid refrigerant from entering the compressor during operating or idle time, and maintain a clean and dry system.

Refrigeration piping shall be Type L, ACR grade, hard drawn seamless copper tubing, wrought type copper fittings, and silver soldered joints. Precharged lines are not acceptable.

FOODSERVICE EQUIPMENT
11 40 00 – 15
PROJECT No. 056-0052 A / 01/07/2022
Furnish and install sleeves for refrigerant and evaporator drain piping wherever piping passes through a wall or ceiling. Sleeves shall be non-conductive gray plastic tubing, with interior dimension sized at least 1/4" larger than piping, and shall be neatly packed with brine putty after installation.

Furnish and install condensate drain piping from the unit cooler to an open drain. Piping shall consist of not less than 7/8" Type L copper tubing, supported 36" on center maximum, in such a way that there will be 1" clearance between the wall and the tubing. Provide a union or slip fitting at the connection to the evaporator drain pan to allow easy disassembly for service and cleaning. Drain piping shall be pitched 4" to the foot and carried through the wall of the refrigerated area. It shall be trapped to prevent entry of warm air and insects to the refrigerated rooms and discharged to a floor drain with the code required air gap. The exposed drain piping shall be spray painted.

Provide an electric drainline heater tape in the freezer, with a length equal to five wraps per foot of length of the drainline located within the freezer compartment. Wrap and secure in accordance with manufacturer's recommendations.

Provide chrome plated escutcheon plates at all exposed points where piping penetrates the wall or ceilings.

Insulation - Suction lines for refrigerated rooms having a temperature above freezing shall be covered with 3/4" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

Suction lines for refrigerated rooms having a temperature below freezing shall be covered with 1" wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

The insulation shall be applied to these lines in accordance with manufacturer's recommendations, and as they are being installed so that insulation will not be split. All joints shall be completely sealed with overlapping, cemented material to prevent the formation of frost on the lines.

Controls - Each evaporator shall be provided with an iNtelliGen electronic control as manufactured by Heatcraft Refrigeration. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

Refrigerant Testing - The entire system shall be pressure and leak tested at no less than 100 PSIG, cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a period of five hours. The required operating charge of refrigerant and oil, if necessary, shall be added and the entire system tested for performance. Each system shall be clearly marked as to the type refrigerant required.

Guarantee - The equipment shall be guaranteed to maintain the specified temperatures. All mechanical refrigeration equipment shall be mechanically guaranteed for a period of one year.
GRANBY MEMORIAL HIGH SCHOOL  
GRANBY, CT

year after date of acceptance by the Owner. The emergency service shall be provided free of charge, whenever necessary on a 24 hour, seven day-per-week basis during the guarantee period.

Any leaks that occur during the first year of operation after acceptance by the Owner, shall be repaired and the necessary refrigerant added at no expense to the Owner.

The year's service shall be provided by the installing company, and under no circumstances will the service policy be sublet to another refrigeration contractor. The name of the installer/service agency for the guarantee period shall be located at a prominent place on the condensing units.

The condensing units shall be provided with an additional four year parts warranty to commence upon the completion of the aforementioned guarantee, bringing the total parts warranty to five years.

Condensing Units - The condensing units shall consist of an EC energy saving motor with variable speed controller, compressor, refrigerant condenser, liquid receiver, compressor service valves, and a dual high-low pressure control. The units shall be as manufactured by Heatcraft Refrigeration.

The condensing units shall be outdoor type, wall mountable, and quiet type with an approximate 51 to 63 decibel rating at 100 percent fan speed. The compressor shall be Microchannel Coil Technology scroll type per schedule, and fitted with gold coated aluminum fin condenser, suction service valve, discharge service valve, compressor contactor, high and low pressure controls, receiver with fusible plug, liquid shut-off valve and charging port, mounted non-fused disconnect switch, waterproof electrical control box, discharge line vibration eliminator, weather resistant UL painted steel cabinet, access guard, liquid line assembly, suction line filter and vibration eliminator, crankcase heater, and 1-1/2" high raised steel base.

Mount on roof per architectural drawings with structural supports, roof penetrations and weatherproofing provided by the General Contractor. Mount with clearance above roof deck per Manufacturers recommendation.

Evaporator Coils - Each evaporator shall be provided with iNtelliGen electronic control as manufactured by Heatcraft Refrigeration, thermostatic expansion valve, and solenoid valve. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit. iNtelliGen Controls to include iIC integration card for BMS connection direct to evaporator controls.

The freezer shall be provided with an automatic electric defrost system consisting of one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with variable speed EC energy saving fan motors with controller. Coil shall be NSF and UL Listed.
The cooler shall be provided with one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with EC energy saving fan motors. Coil shall be NSF and UL Listed.

Furnish and install 1/4" minimum diameter stainless steel threaded mounting rods for the hanging of the evaporator coils, with stainless steel washers and nuts on the interior ends, and reinforcing angle at the exterior top of the room. Plated steel running thread is not acceptable.

Refrigeration Equipment Schedule

<table>
<thead>
<tr>
<th>Cooler (Item 10)</th>
<th>Room Temp:</th>
<th>+35 degrees F</th>
<th>TD:  10 degrees F</th>
<th>Cond Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensing unit (12b)</td>
<td>Amps</td>
<td>Ref</td>
<td>BTU/hour</td>
<td>Evap Temp</td>
</tr>
<tr>
<td>BCH0008MCACZ</td>
<td>4.7 - 208/3</td>
<td>448A</td>
<td>8,300</td>
<td>+25 degrees F</td>
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<tr>
<td>Evaporator coil (12a)</td>
<td>BTU/hour</td>
<td>CFM</td>
<td>Fan amps</td>
<td>Defrost amps</td>
</tr>
<tr>
<td>BEL0095AS6AM</td>
<td>10,000</td>
<td>1,305</td>
<td>1 - 208/1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Freezer (Item 11)</th>
<th>Room Temp:</th>
<th>-10 degrees F</th>
<th>TD:  10 degrees F</th>
<th>Cond Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensing unit (12d)</td>
<td>Amps</td>
<td>Ref</td>
<td>BTU/hour</td>
<td>Evap Temp</td>
</tr>
<tr>
<td>BCH0025LCACZ</td>
<td>8.7 - 208/3</td>
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</tr>
<tr>
<td>Evaporator coil (12c)</td>
<td>BTU/hour</td>
<td>CFM</td>
<td>Fan amps</td>
<td>Defrost amps</td>
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<td>1,371</td>
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<td>9.1 - 208/1</td>
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</tbody>
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Item 12a
COOLER EVAPORATOR COIL
Specified as part of Item 12

Item 12b
COOLER CONDENSING UNIT
Specified as part of Item 12

Item 12c
FREEZER EVAPORATOR COIL
Specified as part of Item 12

Item 12d
FREEZER CONDENSING UNIT
Specified as part of Item 12

Item 13
MOBILE SHELVING UNIT, FOUR-TIER
Quantity - 12
Make - MetroMax Q*C166
Size - (2) 48" x 21" and (10) 36" x 21", all 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 14
MOBILE DUNNAGE RACK
Quantity - 6
Make - New Age 1200-SW Series*C166 or equal by Channel
Size - 36" x 20"
Description - Dunnage platforms shall be all standard construction with 1-1/2" x 1-3/4" x .070" thick wall extruded Type 6063-T5 aluminum tubing with four horizontal tubes and plate mounted casters with unit capable of supporting 1,000 pounds.
Accessories - Provide six total 1208 handles. All casters to swivel.

Item 15
DRY STORAGE SHELVING
Quantity - 11
Make - Metro Super Adjustable Super Erecta or equal by Nexel
Size - (4) 48" x 21", (2) 42" x 21", (1) 42" x 18", and (3) 36" x 21", all 74-5/8" high; five tier with bottom shelf up 14" clear above floor
Description - Unit shall be all standard construction with Super Adjustable Chrome plated wire shelves and tubular steel uprights with capped tops, adjustable feet, and 1" shelf height adjustment capability with Corner Release System. Each unit shall include four legs.

Item 16
DUNNAGE RACK
Quantity - 2
Make - New Age 2000 Series*C166 or equal by Channel
Size - (1) 42" x 20" and (1) 36" x 20", all 12" high
Description - Dunnage platforms shall be all standard construction with 1-1/2" x 1-3/4" x .070" thick wall extruded Type 6063-T5 aluminum tubing with four horizontal tubes and four legs welded together, and each unit capable of supporting a minimum of 2,500 pounds.

Item 17
No item

Item 18
No item

Item 19
ICE CUBER
Make - Manitowoc IDT0420A/D320 or equal by Scotsman or Hoshizaki
Size - 22 in. by 34 in. by 59-1/2 in. high
Power - 5.5 amps - 208/60/1
Capacity - 470 pounds of cubes per day at 70/50 degrees
Maximum Water Use - 19.9 gallons/100 lbs of ice
Certification - Unit shall be Energy Star compliant
Description - Ice cuber shall be all standard construction with an air-cooled condenser, automatic controls, R410A refrigerant, self-cleaning and sanitizing system, digital display diagnostic, system information and programmable ice production, vertical freezing plate with half dice sized cubes, bin level thermostat, and housed in a stainless steel cabinet with gray ABS accents. Bin shall have 264 pound capacity with compression molded composite resin base, hinged lift-up door, internal scoop holder, polyethylene liner and stainless steel exterior wrap. Mount on stainless steel adjustable legs. Provide unit with standard 3 year parts and labor warranty on total machine, 5 year parts and labor warranty on the evaporator and 5 year parts warranty on the compressor.

Item 20
ICE BIN
Specified as part of Item 19

Item 21
WATER FILTER ASSEMBLY
Make - 3M ICE140-S*C166 or equal by Everpure or Selecto
Size - 5-1/4" x 5" x 15" verify clearance below to remove cartridge
Description - Unit shall be all standard construction and consist of a head assembly with integral mounting bracket, quarter-turn cartridge release mechanism, "valve-in-head" automatic shut-off upon removal of cartridge, pressure gauge, and filter cartridge with internal pre-filter membrane designed for ice makers. Cartridge shall be capable of removal to .2 micron or larger particles, remove chlorine and off tastes and odors, inhibit scale build-up, service flow rate of up to 3.34 gallons per minute, and meet requirements of NSF Standards 42 and 53 and be so listed.
Accessories - Provide three spare filter cartridges

Item 22
FLOOR PAN & GRATE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 24" x 12" x 4" deep inside dimensions; 27" x 15" overall
Description - Pan shall be fabricated of 14 gauge stainless steel, all welded construction, pitched to a 4" ID drain fitting with stainless steel removable, perforated basket. Two opposing sides shall be fitted with integral grate support ledges. Pan shall be set in floor so that grate ledges are parallel with cooking line aisle. Provide a model I4010 ADA compliant pultruded grate (Fibergrate Safe-T-Span) with 0.60" load bars, 0.4" clear slots and ends finished in accordance with manufacturer's instructions. Grate shall rest in pan so that slots are perpendicular to the cooking line aisle, and shall be cut in a manner that closed pockets will not be formed where they rest on the pan ledges.

Item 23
PREP TABLE WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 9'-0" x 30" x 36" high to work surface plus 10" high splash at rear; two 18" x 20" x 10" deep integral sink basins

FOODSERVICE EQUIPMENT
11 40 00 – 20
PROJECT No. 056-0052 A / 01/07/2022
Construction - 14 gauge stainless steel top, basins and splash, channel reinforced, six legs with gussets and adjustable feet, partial undershelf, two crossrails, tall splash rear, and marine front and ends, secured 3" off face of wall.

Accessories - Drawer assembly, splash mounted faucet set and two 2" lever waste outlets.

Item 24
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 9'-0" x 10" mounted 1" off face of wall up 54" above finished floor

Item 25
FOOD PROCESSOR
Make - Robot Coupe R301 Ultra*C166
Power - 12 amps - 120/60/1 - cord and plug
Description - Combination food cutter shall be all standard construction with 1-1/2 HP direct drive fan cooled capacitor start motor with brake, magnetic interlocks, stainless steel cutter bowl with handle and see-thru lid, continuous feed top unit with attached large feed pusher and two standard discs.

Item 26
TRASH BARREL
No work in this Section. Item to be provided by Owner.

Item 27
HAND SINK
Quantity - 2
Make - Advance 7-PS-70-CM*C166 or equal by Krowne
Description - Units shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36" above floor
Accessories - Provide with a splash mounted faucet set with wrist handles (Item 27a), 3" flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide stainless steel welded end splash on right side of one unit adjacent to Item 23. Provide stainless steel welded end splashes on both sides of one unit adjacent to Items 89 and 93.

Item 27a
FAUCETS
Quantity - 2
Make - T&S Brass B-0330-04 modified or Fisher 1953 modified
Description - Units shall be all standard construction with mixing body, 8" center inlets, and wrist blade handles. Modified unit shall be provided with a B-0413 swivel to rigid adapter, and a 119X gooseneck with B-0199-02-F10, 1.0 gallons per minute aerator tip in lieu of the standard.
Item 28
WASTE BIN
Quantity - 3
No work in this Section. Item to be provided by Owner.

Item 29
MOBILE WORK TABLE
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 60" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5" diameter swivel casters, two with brakes, and full undershelf.
Accessories - Drawer assembly.

Item 30
DROP CORD ASSEMBLY
Make - World Cords (860/763-2100) Model 88-DC-2003-A4-GM
Power - 20 amps - 120/60/1
Description - Cord shall be all standard construction with female connector body, cord, strain relief, stainless steel ceiling plate, inline GFCI protection with integrated test and reset buttons, and manual reset. Cords shall be adjusted to hang to 78" above floor. Plastic wire ties are not acceptable for this work.

Item 31
ADA PREP TABLE WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 6 ft., 7 in. by 30 in. by 34 in. high plus 6 in. backsplash; 14 in. by 16 in. by 6-1/2 in. deep integral sink basin; offset drain to rear left.
Construction - 14 gauge stainless steel top over angle frame with rear formed in short splash, front and ends formed in turndown, mounted on six legs with gussets and adjustable feet, and five crossrails. Secure to wall and seal. Provide basin with a lift out, 16 gauge stainless steel cover with all edges flanged down 1 in. and corners rounded, provided with two neatly punched thumb holes, and designed to rest on 1/4 in. rod stock supports welded across the basin corners at proper height to provide a flush surface.
Accessories - Crumb cup waste outlet, T&S Brass B-0323-04 faucet, or equal by Fisher or Encore, with 6 in. wrist blade handles.

Item 32
ADA HAND SINK
Make - Advance 7-PS-25 modified or equal by Eagle or Aero
Size - 20 in. by 24 in. by 13 in. high overall, 14 in. by 16 in. x5 in. deep sink bowl
Description - Unit shall be all standard stainless steel construction with wall mounting bracket. Mount on wall with rim at 34 in. above floor. Modify faucet holes to be two holes spaced 8 in. apart on center. Delete standard faucet.
Accessories - Deck mounted soap dispenser, 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide stainless steel end splash welded to left side.

Item 32a
FAUCET
Make - T&S Brass B-0322-04 modified or equal by Fisher or Encore
Description - Unit shall be all standard construction with deck mounted mixing body, 8" center inlets, and wrist blade handles. Modified unit shall be provided with B-0199-02F-12 aerator tip in lieu of the standard.

Item 33
OFFICE DESK
No work in this Section. Item to be provided and installed by General Contractor.

Item 34
FILE CABINET
No work in this Section. Item to be provided and installed by General Contractor.

Item 35
BUN PAN RACK
Quantity - 3
Make - New Age 1332*C166 or equal by Channel
Size - 20-1/2" x 26" x 69" high
Capacity - Fifteen 18" x 26" pans on 4" centers
Description - Rack shall be fabricated of welded extruded aluminum 1" x 1" x .070" tubular uprights and framing, and 1-1/4" x 1-5/8" x .100" angle pan slides with corners chamfered and deburred. Gussets of 1-1/2" x 1-1/2" x 5/8" angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5" polyurethane tired swivel casters.

Item 36
No item

Item 37
DOUBLE CONVECTION OVEN
Quantity - 2
Make - Blodgett DFG-200-ES Double*C166 or equal by Southbend
Size - 38-1/4" x 42-7/8 to include fan motor x 70-5/8" high
Power - (2) 8 amps - 1/3 HP - 120/60/1 - cords and plugs
Rating - 3/4" gas inlet at 100,000 BTU/Hour
Certification - Unit shall be Energy Star compliant
Description - Units shall be all standard construction with stainless steel front, sides and top, porcelain enameled steel interior with 29" x 28-1/4" x 20" high inside dimensions, 1" thick mineral fiber sheet insulation on top, back and sides, dual pane thermal glass windows in coupled doors, removable rack supports capable of holding eleven racks and five chrome plated steel wire racks, electronic ignition with fail-safe controls, solid state digital controls.
with separate temperature and time settings, timer with buzzer, cook and hold and fan pulse modes, manual gas service cut-off switch, removable dual tube burners, pressure regulators, two speed blowers with thermal overload protection and door interlock, and interior lighting with two 50 watt commercial bake oven lamps. Provide standard three year parts and labor warranty on the total oven and additional five year warranty on the door assembly exclusive of glass, parts only.

Accessories - Mount on heavy duty swivel casters. Manifold the two ovens for a single gas connection. Provide assembly with a 48" long x 3/4" line size Dormont 1675 KIT2S plastic covered hose assembly with full port gas ball valve, two Supr-Swivels, brass disconnect, 90° street elbow and restraining cable. Mount the nipple on the rear of the oven, and the hose assembly with disconnect device connected to the building supply line.

Item 38
FORTY GALLON BRAISING PAN
Make - Groen BPP-40GC*C166 or equal by Market Forge
Size - 35-3/4" x 28-1/4" x 10" deep inside pan dimensions
Power - 5 amps - 120/60/1
Rating - 1/2" gas inlet at 144,000 BTU/Hour
Description - Unit shall be all standard stainless steel construction, with tubular support frame, adjustable feet, flanged feet at rear, electric motorized crank tilt mechanism with manual override and three position control switch, torsion bar counterbalanced hinged cover with vent, and a 40 gallon pan. The cooking surface shall be constructed with 5/8" thick stainless steel and bonded clad plate with integral heat transfer fins, and a multi-tube gas burner. Pan shall be polished to a 100 emery grit finish and provided with electronic ignition, 7° off level cooking capable, power on switch and indicator light, heat on indicating light, thermostatically controlled and provided with a high limit cut-off.

Accessories - Provide unit with a faucet mounting bracket with a double pantry water fill faucet and aerator tip, and BPC pan carrier.

Item 39
FLOOR PAN & GRATE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 20" x 36" x 4" deep inside dimensions; 23" x 39" overall
Description - Pan shall be fabricated of 14 gauge stainless steel, all welded construction, pitched to a 4" ID drain fitting with stainless steel removable, perforated basket. Two opposing sides shall be fitted with integral grate support ledges. Pan shall be set in floor so that grate ledges are parallel with cooking line aisle. Provide a model I4010 ADA compliant pultruded grate (Fibergrate Safe-T-Span) with 0.60" load bars, 0.4" clear slots and ends finished in accordance with manufacturer's instructions. Grate shall rest in pan so that slots are perpendicular to the cooking line aisle, and shall be cut in a manner that closed pockets will not be formed where they rest on the pan ledges.
Item 40
FOUR-BURNER RANGE WITH OVEN
Make - Vulcan 24S-4BN*C166 or equal by Southbend
Size - 24" x 32" x 37" high to work surface; 47" high overall
Rating - 3/4" gas inlet at 143,000 BTU/hour
Description - Range shall be all standard construction with fully welded aluminized steel frame, four 30,000 BTU/hour open burners with one pilot lights for every two burners, level cast iron removable grates, stainless steel front, sides, and back riser, 20-1/4" x 26" x 14-1/2" high thermostatically controlled 23,000 BTU/hour oven with two racks and safety pilot, full width pull-out crumb tray below burners, and provided with pressure regulator.
Accessories - Provide with Flame Safety device with manual spark ignition for all open top burners, and oven pilot. Provide a 10" high stainless steel flue riser. Mount unit on 5" diameter heavy duty swivel casters, two with brakes. Provide assembly with a 48" long x 3/4" line size Dormont 1675 KIT2S plastic covered hose assembly with full port gas ball valve, two Supr-Swivels, brass disconnect, 90° street elbow and restraining cable. Mount the nipple on the rear of the oven, and the hose assembly with disconnect device connected to the building supply line.

Item 41
EXHAUST VENTILATOR
Make - CaptiveAire 6024 ND-2 (DWG# 4949718) or equal by Gaylord or Halton
Size - 15'-6" x 60" x 24" high plus 4" high collars, mounted up 6'-8" above finished floor; flat bottom
Power - Power to lights from Item 45
Exhaust - 3,642 CFM thru two 14" diameter collars @ -0.792" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.
Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edge with integral front baffle, double sidewall construction, and NSF Listed. Unit shall have grease collection trough, storage container, and hanger brackets. Provide with UL Listed stainless steel baffle type extractors. Provide all materials necessary for the hanging of the ventilator.
Accessories - Provide with six UL Listed recessed LED light fixtures, factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3 in. above finished ceiling to close to adjacent surfaces on three sides. Provide with quarter end panels and filter removal tool.

Item 43
STAINLESS STEEL WALL FLASHING
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 15'-6" extending from bottom of ventilator to floor or top of coved material
Construction - Wall shall be clad with 20 gauge type 304 stainless steel cut in largest sheets to minimize joints and secured to wall with adhesive and no exposed fasteners. Provide Component Hardware J64-1450 "T" dividers at joints and J63-1451 cap strips at ends. Provide carefully punched holes at all service locations.
Item 44
FIRE SUPPRESSION SYSTEM
Make - Ansl R-102
Protection for hood: 41
Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted on wall per plan, 80" high to bottom and within a 16-1/2" x 7-1/2" x 23-1/2" high stainless steel cabinet and piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel or chrome and limited to vertical drops only. Horizontal piping shall be run over the ventilator's top. Nozzles shall be swivel type with metal caps. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide a properly sized mechanically operated gas shut-off valve (up to 3" diameter) for mounting by the Plumber at a point in the gas supply that will shut off fuel to all gas fired equipment. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a recessed junction box mounted for installing the pull box with cable conduit concealed within walls. Provide system with class-K extinguisher as required.

Workmanship - Exposed stainless steel fittings and piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. Chrome sleeves are not acceptable.

Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.

Accessories - Provide metal caps on the nozzles.

Item 45
VENTILATOR DEMAND CONTROL SYSTEM
Make - CaptiveAire DCV-1011 (DWG# 4949718) or equal by Gaylord or Halton
Power - 20 amps circuit - 120/60/1 to logic controller
Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturer's shop drawings. The system shall include programmable logic controller (PLC), variable frequency drive (VFD), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Item 41. Mount LCD screen control, recessed and flush to wall per plan 60" above floor. Mount LCD screen control in a recessed junction box provided by the General Contractor. Mount system processor in a stainless steel cabinet, wall mounted per plan at 80" high minimum above the floor. Mount the room air temperature sensor on the wall 66" above the finished floor.

Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the DCV hood system. Submittal shall
list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.

Accessories - Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturer’s service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration. Provide BacNet monitoring system.

Item 45a
DEMAND CONTROL SYSTEM INTERFACE SCREEN
Specified as part of Item 45

Item 45b
ROOM TEMPERATURE SENSOR
Specified as part of Item 45

Item 46
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102
Protection for hood: 71
Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted on wall per plan, 80" high to bottom and within a 16-1/2" x 7-1/2" x 23-1/2" high stainless steel cabinet and piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel or chrome and limited to vertical drops only. Horizontal piping shall be run over the ventilator’s top. Nozzles shall be swivel type with metal caps. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide a properly sized mechanically operated gas shut-off valve (up to 3” diameter) for mounting by the Plumber at a point in the gas supply that will shut off fuel to all gas fired equipment. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a recessed junction box mounted for installing the pull box with cable conduit concealed within walls. Provide system with class-K extinguisher as required.
Workmanship - Exposed stainless steel fittings and piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. Chrome sleeves are not acceptable.
Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.
Accessories - Provide metal caps on the nozzles.
Item 47
VENTILATOR DEMAND CONTROL SYSTEM
Make - CaptiveAire DCV-1011 (DWG# 4949718) or equal by Gaylord or Halton
Power - 20 amps circuit - 120/60/1 to logic controller
Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturer's shop drawings. The system shall include programmable logic controller (PLC), variable frequency drive (VFD), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Item 71. Mount LCD screen control, recessed and flush to wall per plan 60" above floor. Mount LCD screen control in a recessed junction box provided by the General Contractor. Mount system processor in a stainless steel cabinet, wall mounted per plan at 80" high minimum above the floor. Mount the room air temperature sensor on the wall 66" above the finished floor.

Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the DCV hood system. Submittal shall list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.

Accessories - Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturers service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration. Provide BacNet monitoring system.

Item 47a
DEMAND CONTROL SYSTEM INTERFACE SCREEN
Specified as part of Item 47

Item 47b
ROOM TEMPERATURE SENSOR
Specified as part of Item 47

Item 48
No item

Item 49
COOK'S WORK TABLE WITH OVERSHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusettes, LTI, or SML Stainless Steel Group
Size - 9'-0" x 30" x 36" high; overshelf 9'-0" long with shelf at 54" above floor; 20" deep shelf
Construction - 14 gauge stainless steel top over angle frame, edges formed in turndown, six legs with gussets, adjustable feet, flanged feet at the corners for securing to floor, two crossrails and partial undershelf. Overshelf shall be 16 gauge stainless steel with edges formed in turndown, channel reinforced, and welded to three extended rear table legs with support webs, and supported in integrally welded inverted gussets with sleeved joints for rigidity.
Accessories - Drawer assembly. Provide three rigid stainless steel brackets for mounting of electric outlets in setback positions below the top, complete with work boxes, GFI receptacles and...
stainless steel cover plates. Provide one stainless steel enclosed outlet box for mounting of electric outlet in setback position below the overshelf complete with GFI receptacle and stainless steel cover plate. Mount below the overshelf and pre-wire thru upright to junction box mounted below the table.

Item 50
TRASH BARREL
Quantity - 5
No work in this Section. Item to be provided by Owner.

Item 51
WORK TABLE WITH OVERSHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 9'-0" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame, edges formed in turndown, six legs with gussets, adjustable feet, two crossrails and partial undershelf.
Accessories - Drawer assembly. Provide two rigid stainless steel brackets for mounting of electric outlets in setback positions below the top, complete with work boxes, GFI receptacles and stainless steel cover plates.

Item 52
CEILING MOUNTED UTENSIL RACK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 5'-6" x 24" mounted up 6'-6" and 7'-6" above floor
Construction - Rack shall be fabricated of 1/4" x 2" stainless steel bar stock throughout, fully welded construction, consisting of a two bar upper rail with full radiused ends, a single lower rail, reinforcing straps, and suspended from the overhead structure on four hangers. Provide unit with forty-eight Component Hardware J77-4401 stainless steel double pot hooks.

Item 53
MOBILE EQUIPMENT STAND
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 30" x 30" x 32" high
Construction - 14 gauge stainless steel top over channel frame, edges formed in turn down, mounted on four legs with gussets, undershelf, and 5" diameter casters, two with brakes.

Item 54
SLICER
Make - Hobart HS9 or equal by Bizerba
Power - 5.6 amps - 1/2 HP - 120/60/1 - cord and plug
Description - Slicer shall be all standard construction, automatic type with anodized cast aluminum housing and base, removable 13" diameter 304L stainless steel knife with removable ring guard cover, totally enclosed, permanently lubricated PSC knife motor, with poly-v belt.
drive, zero knife exposure, linear automatic carriage drive system with speeds of 28, 38, 48 and 58 strokes per minute, manual assist mode, and provided with thermoplastic coated steel feed grip, glass bead finished gauge plate and knife cover, tilting carriage, water protected push-button switches, top mounted and removable knife sharpener with two borazon stones, adjustable gauge plate from "0" to 1", lift lever system and rubber feet. Unit to be provided with mechanical and electrical interlocks to include home position start, close gauge plate to stop, carriage will not tilt away or remove if gauge plate is not closed, locked gauge plate when carriage is removed, no-volt release, and 30 second automatic shut-off without carriage motion. Slicer shall be NSF 8 compliant.

Accessories - Provide unit with knife removal tool

Item 55
TWENTY-QUART MIXER
Make - Hobart HL-200 or equal by Globe or Univex
Power - 8 amps - 1/2HP - 120/60/1 - cord and plug
Description - Mixer frame and body shall be fabricated of welded heavy gauge steel finished in Hybrid Powder coat finish, and provided with a stainless steel splash guard at the column, stainless steel bowl guard with electrical interlock, single point bowl installation with swing-out bowl support, manual bowl lift and an attachment hub with No. 12 taper. Transmission shall be gear driven constant mesh heat treated and hardened gears on similar shafts be mounted in ball bearings with recirculating oil and grease to all gears and shafts. Mixing action shall be planetary and shall have speeds of 59 (stir), 107, 198, 365, agitator RPM speeds as selected by an external dial. Speeds to be selectable on-the-fly and include a soft start and stir speed while lifting the bowl into place and controlled with a 15 minute timer with automatic time recall

Accessories - Provide mixer with a 20 quart stainless steel bowl, one flat "B" beater and one "D" wire loop whip with stainless steel wires.

Item 56
PASS-THRU WARMING CABINET
Make - Victory HS-2D-PT-HD, or equal by Continental
Size - 52-1/8 in. by 35-1/4 in. by 84-1/4 in. high overall
Power - 13 amps - 208/60/1 - cord and plug (NEMA L14-20P)
Doors - Half height, standard hinging
Description - Heated cabinet shall be all standard construction with stainless steel exterior, stainless steel coved interior floor and ceiling, stainless steel interior walls and door liner, foamed-in-place polyurethane insulation, self-closing door hardware with a hold-open at 120°, automatic interior lighting, exterior digital thermometer, heavy duty epoxy plated wire shelves adjustable in one inch increments, built-in adjustable humidity control vent, externally mounted blower, safety shielded strip type heating elements, adjustable electronic temperature control from 80 degrees to 180 degrees Fahrenheit with Secure-Temp 1.0 temperature monitoring technology.

Accessories - Provide adjustable tray slide kit in the top and bottom sections. Mount 6” high casters.
Item 57
PASS-THRU REFRIGERATOR
Make - Victory RSA-1D-S1-PT-HD-HC, or equal by Continental
Size - 58-3/8 in. by 35 in. by 84-1/4in. high overall
Capacity - 22.9 cubic feet
Power - 6.5 amps - 120/60/1 - cord and plug
Doors - Half height, hinged on right
Certification - Unit shall be Energy Star compliant
Description - Refrigerator shall be all standard construction with stainless steel exterior, aluminum interior, self-closing door hardware with a hold-open at 120°, Humidity control wires around the door jamb, automatic LED interior lighting, exterior digital thermometer, heavy duty epoxy plated wire shelves adjustable in one inch increments, self-contained top mounted refrigeration system capable of maintaining a 33° to 38° temperature range with Secure-Temp 1.0 temperature monitoring technology, R-290 refrigerant, and condensate evaporator.
Accessories - Provide adjustable tray slide kit in the top half, and two shelves in the bottom half. Provide unit mounted on casters.

Item 58
WORK TABLE WITH OVERSHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 7'-0" x 30" x 36" high; overshelf 7'-0" long with shelf at 54" above floor; 10" deep shelf
Construction - 14 gauge stainless steel top over angle frame, edges formed in turndown, six legs with gussets, adjustable feet, flanged feet at the corners for securing to floor, two crossrails and partial undershelf. Overshelf shall be 16 gauge stainless steel, constructed similar to a wall shelf, channel reinforced, and welded to three extended rear table legs with support webs, and supported in integrally welded inverted gussets with sleeved joints for rigidity.
Accessories - Drawer assembly. Provide two rigid stainless steel brackets for mounting of electric outlets in setback positions below the top, complete with work boxes, GFI receptacles and stainless steel cover plates.

Item 59
PASS-THRU WARMING CABINET
Make - Victory HS-1D-1-PT-HD, or equal by Continental
Size - 26-1/2 in. by 35-1/4 in. by 84-1/4 in. high overall
Power - 6.3 amps - 208/60/1 - cord and plug (NEMA 6-20P)
Doors - Half height, hinged on left
Description - Heated cabinet shall be all standard construction with stainless steel exterior, stainless steel coved interior floor and ceiling, stainless steel interior walls and door liner, foamed-in-place polyurethane insulation, self-closing door hardware with a hold-open at 120°, automatic interior lighting, exterior digital thermometer, heavy duty epoxy plated wire shelves adjustable in one inch increments, built-in adjustable humidity control vent, externally mounted blower, safety shielded strip type heating elements, adjustable electronic temperature control from 80 degrees to 180 degrees Fahrenheit with Secure-Temp 1.0 temperature monitoring technology.
Accessories - Provide adjustable tray slide kit in the top and bottom sections. Provide unit mounted on 6” high casters.

Item 60
PASS-THRU REFRIGERATOR
Make - Victory RSA-2D-S1-PT-HD-HC, or equal by Continental
Size - 52-1/8 in. by 38-5/8 in. by 84-1/4 in. high overall
Capacity - 48.33 cubic feet
Power - 6.5 amps - 120/60/1 - cord and plug
Doors - Half height, standard hinging both sides
Certification - Unit shall be Energy Star compliant
Description - Refrigerator shall be all standard construction with stainless steel exterior, aluminum interior, self-closing door hardware with a hold-open at 120°, Humidity control wires around the door jamb, automatic LED interior lighting, exterior digital thermometer, heavy duty epoxy plated wire shelves adjustable in one inch increments, self-contained top mounted refrigeration system capable of maintaining a 33° to 38° temperature range with Secure-Temp 1.0 temperature monitoring technology, R-290 refrigerant, and condensate evaporator.
Accessories - Provide adjustable tray slide kit in the top half, and two shelves in the bottom half.

Provide unit mounted on casters.

Item 61
TRASH BIN
No work in this Section. Item to be provided by Owner.

Item 62
DELI SERVING COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 12'-0" x 39" x 34" high, plus 6" high splash at wall; 62" x 30" notch at Item 63
American Disabilities Act Requirements - Food pans and breath guards shall be mounted in accordance with ADA code requirements for side reach per code section 4.2.6.
Power - 20 amps circuit - 120/60/1 to each of three body mounted GFI outlets
20 amps circuit - 120/60/1 to apron mounted GFI outlet
Construction - 14 gauge stainless steel top over angle frame with all edges down 2 in. and corners welded except wall end formed in short splash. Provide a raw opening for the hot food well, and a flanged opening for the refrigerated pan with all edges flanged down 1 in. and corners filled and welded.

Mount on eight 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelf shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45°. Rear and ends shall be turned up 1-1/2 in. and corners
welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with plastic laminate clad panels. Plastic laminate manufacturer shall be as selected by the Architect. Plastic laminate color shall be as selected by the Architect from Wilsonart's full range of colors. Panels shall be mounted with a minimum of joints. All joints to be hairline type. Joint between a front and end panel shall appear on the end panel face. Panels shall be secured to counter legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16 in. past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face.

Accessories - Provide with a 66 in. long (between end posts on centers) Versa-Gard VP2 food protector (Item 64) with brushed stainless steel uprights, one end panel, surface mounted flanges, and mounted over prep refrigerator per plan. Provide with a 55 in. long (between end posts on centers) Versa-Gard VG21-SK convertible food protector (Item 67) with brushed stainless steel uprights, surface mounted flanges, and mounted over cold pan and hot well per plan.

Item 63
SANDWICH PREP REFRIGERATOR
Make - Victory VSP60HC-16*C166 or equal by Beverage Air or True
Size - 60" x 32-7/8" x 36" high to work surface
Power - 5.4 amps - 1/3 HP - 120/60/1 - cord & plug
Capacity - 16 cubic feet
Description - Unit shall be all standard construction with stainless steel exterior, galvanized back and bottom, aluminum interior, hinged insulated flat top lid, heavy-duty pan liner, top recessed pan to accommodate up to twelve 6" deep 1/6 pans, locking divider bars, two self-closing doors with removable magnetic gaskets, low-profile door handles, two epoxy coated shelves, 10" deep removable cutting board, self-contained, air cooled refrigeration system with R-290 refrigerant, epoxy coated evaporator coil, electronic control, and mounted on 6" high casters, two with brakes.
Accessories - Provide with optional four-year compressor warranty, 16-Pan cover, Secure-Temp system, and stainless steel back. Mount on 4" high casters for a 34" high work surface.

Item 64
VERTICAL GLASS FOOD PROTECTOR WITH TOP SHELF
Specified as part of Item 63
Item 65
DROP-IN HOT FOOD WELL
Make - Wells MOD100D-120*C166 or equal by APW/Wyott
Power - 10 amps - 1.2 KW - 120/60/1 - cord and plug
Description - Modular food warmer shall be all standard construction and shall consist of a stainless steel mounting frame, gasket and locking system, stainless steel 6” deep "wet or dry" hot food well with 1" thick fiberglass insulation on five sides enclosed in an aluminized steel enclosure, and an infinite heat control with mounting panel for installation in the counter apron complete with gasket, lead wires encased in flexible armored conduit, drain outlet, and mounting hardware. Wells shall be Fabricator wired to a single point with disconnect switch in accordance with UL Requirements.
Accessories - Provide with drain valve extension kit and cord and plug set

Item 66
DROP-IN FROST TOP
Make - Hatco FTB-1*C166 or equal by Randell or Wells
Power - 6.7 amps - 120/1 - cord and plug
Description - Provide manufacturer’s standard utilizing R-404A refrigerant and consist of aluminized steel housing, electronic adjustable temperature control, condensing unit, compressor, and flexible refrigerant lines. Unit accommodates full and half size sheet pans. NSF 7 approved cold wall construction, and auto-defrost.
Accessories - Provide additional four year parts warranty on compressor.

Item 67
CONVERTIBLE GLASS FOOD PROTECTOR
Specified as part of Item 63

Item 68
HOT FOOD SERVING COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 21'-0" x 39" x 34" high
American Disabilities Act Requirements - Food pans and breath guards shall be mounted in accordance with ADA code requirements for side reach per code section 4.2.6.
Power - 20 amps circuit - 120/60/1 to each of three apron mounted GFI outlets
20 amps circuit - 120/60/1 to body mounted GFI outlet
Construction - 14 gauge stainless steel top over angle frame with all edges turned down 2 in. and corners welded. Provide raw openings for the hot food wells, griddle, and heated surface

Mount on twelve 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45°. Rear and ends shall be turned up 1-1/2 in. and corners
welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with plastic laminate clad panels. Plastic laminate manufacturer shall be as selected by the Architect. Plastic laminate color shall be as selected by the Architect from Wilsonart's full range of colors. Panels shall be mounted with a minimum of joints. All joints to be hairline type. Joint between a front and end panel shall appear on the end panel face. Panels shall be secured to counter legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16 in. past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face.

Accessories - Provide with a 66 in. long (between end posts on centers) Versa-Gard VG6S food protector (Item 74) with brushed stainless steel uprights, surface mounted flanges, end panels, and mounted over hot wells per plan. Provide with a 51 in. long (between end posts on centers) Versa-Gard VP24 vertical food protector (Item 77) with brushed stainless steel uprights, end panels, surface mounted flanges, and mounted in front of griddle per plan. Provide with a 54 in. long (between end posts on centers) Versa-Gard VG21-SK convertible food protector (Item 76) with brushed stainless steel uprights, surface mounted flanges, end panels, mounted warmer, and mounted over heated surface top per plan.

Item 69  
TWO-TIER HEATED DISPLAY SHELF
Make - Hatco GRSDS/H-36D*C166
Size - 36" x 24" x 32-1/2" high
Power - 15.1 amps - 1.81 KW - 120/60/1 - cord and plug
Description - Unit shall be all standard construction with two heated shelves, one slanted and one flat, with Hardkote finish, constructed of stainless steel and extruded aluminum with tempered glass end panels, incandescent lights, dividers, and thermostatic controls.

Item 70  
DROP-IN ELECTRIC GRIDDLE
Make - Lang 136TDI
Size - 38-1/2" x 28-1/2" x 11" high
Power - 50 amps - 18.0 KW - 208/60/3
Description - Griddle shall be all standard construction, 1" thick polished steel cooking surface, full parameter stainless steel top mounting flange, full front stainless steel grease trough, 8-quart capacity grease drawer with removable fully enclosed sleeve, snap-action thermostat controls for every 12” of griddle width, sheathed heating elements pressure clamped to plate bottom, and designed for drop-in installation in the counter top.
Item 71
EXHAUST VENTILATOR
Make - CaptiveAire 6024 ND-2WI (DWG# 4949718) or equal by Gaylord or Halton
Size - 6'-2" x 60" x 24" high plus 4" high collar, mounted up 6'-8" above finished floor; flat bottom
Power - Power to lights from Item 47
Exhaust - 1,800 CFM thru a 14" diameter collar @ -0.854" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.
Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edges with integral front baffle, double wall insulated fronts, and NSF Listed. Unit shall have grease collection troughs, storage containers, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 90% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator.
Accessories - Provide unit with three UL Listed recessed LED light fixtures with factory prewired and left ready for final connection by the Electrical Contractor. Provide with stainless steel back and insulated end panels. Provide closure trim per detail to a point 3" above finished ceiling to close to adjacent surfaces on four sides. Provide one filter removal tool, and full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 72
DROP-IN HOT FOOD WELL
Quantity - 4
Make - Wells MOD-100D*C166 or equal by APW/Wyott
Power - 0.9 KW - 208/60/1
Description - Modular food warmer shall be all standard construction and shall consist of a stainless steel mounting frame, gasket and locking system, stainless steel 6" deep "wet or dry" hot food well with 1" thick fiberglass insulation on five sides enclosed in an aluminized steel enclosure, and an infinite heat control with mounting panel for installation in the counter apron complete with gasket, lead wires encased in flexible armored conduit, drain outlet, and mounting hardware. Wells shall be Fabricator wired to a single point with disconnect switch in accordance with UL Requirements.
Accessories - Mount in a group of four and provide a quarter turn ball type shut-off valve and Fabricator installed 3/4" copper manifold connecting the wells, complete with cleanout, left ready for extending to the floor drain by the Plumbing Contractor.

Item 73
FILL FAUCET
Make - T&S Brass B-0208 or equal by Fisher or Encore
Description - Unit shall be all standard construction with a B-199-02F-12 aerator tip.
Item 74
FULL SERVICE GLASS FOOD PROTECTOR
Specified as part of Item 68

Item 75
HEATED BLACK GLASS SURFACE
Make - Hatco HBGB-4818*C166
Size - 48" x 18" plus perimeter flange
Power - 7.1 amps - 850 watts - 120/60/1 - cord and plug
Description - Black ceramic glass aluminum surface with thermostatic controlled heated base with 100° to 200°F. range, stainless steel flanged edge for drop-in installation, and remote control box.
Accessories - Provide with flush mount control box with lighted power switch for mounting in counter apron.

Item 76
CONVERTIBLE GLASS FOOD PROTECTOR WITH WARMER
Power - 5.3 amps - 1.1 KW - 208/60/1
Food protector assembly specified as part of Item 68
Accessories - Provide a mounted Hatco GRNH-48 warmer pre-wired through upright for connection to remote RMB-7G control mounted in counter apron.

Item 77
VERTICAL GLASS FOOD PROTECTOR
Specified as part of Item 68

Item 78
MILK COOLER
Make - Beverage-Air SMF58HC-1-S*C166 or equal by Continental or True
Size - 58" x 33-1/2" x 47" high; sixteen 13" x 13" x 11" milk crate capacity
Power - 3.3 amps - 1/3 HP - 120/60/1 - cord and plug
Description - Milk cooler shall be all standard construction with stainless steel interior and exterior front and ends, self-contained refrigeration system with thermostatic controls and blower, urethane foam insulation, exterior dial thermometer, and hinged and lockable drop-front covers. Interior shall be fitted with a vinyl coated wire rack. Mount on 4" diameter swivel casters and provide with R-290 refrigerant.
Accessories - Provide unit with optional five year compressor warranty.

Item 79
GRAB & GO DISPLAY REFRIGERATOR
Make - Structural Concepts NR6040RSSV*C166 or equal by RPI
Size - 59-3/4" x 33" x 39-5/8" high overall
Power - 16 amps - 120/60/1 - cord and plug (NEMA L5-20P)
Description - Display case shall be all standard construction with vertical fixed end glass panels, top and shelf mounted LED lights, one adjustable cantilevered metal shelf, solid back panel, black interior, black top exterior frame, plastic laminate clad exterior in color as selected by Architect from non-standard selection, digital thermometer, one piece formed ABS plastic
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

- Tub, self-contained slide-out refrigeration system with adjustable control, condensate evaporator and coil capable of maintaining average product temperature of 40°F or less. Mount on adjustable locking casters.

Accessories - Provide unit with retractable night curtain, premium exterior laminate option, clean sweep coil cleaner, and locking cord set.

Item 80
CASHIER STAND
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 84" x 30" plus two 12" x 10" extensions at ends x 34" high
Construction - 14 gauge stainless steel top over angle frame with all edges turned down 2" and corners welded. Mount on six 2" square legs front to back and rear crossrails, two footrests set in 8", shallow undershelf, and plastic laminate clad panels on three sides all of similar construction to the serving counter. Provide two 3" diameter grommeted holes in top below rear of cashier terminals for passage of cables. Provide legs with 5" diameter swivel casters; two with brakes.

Accessories - Provide unit with two Component Hardware S95-1000 locking cashier drawers.

Item 81
CASHIER TERMINAL
Quantity - 2
No work in this Section. Item to be provided by Owner.

Item 82
MOBILE CONDIMENT COUNTER
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 48" x 27" x 34" high
Construction - 14 gauge stainless steel top over angle frame with all edges turned down 2" and corners welded. Mount on four 2" square legs with undershelf and plastic laminate clad panels on four sides all of similar construction to the serving counter. Rear face shall be provided with a pair of hinged doors in a 36" wide opening. Provide 5" diameter swivel casters; two with brakes.

Item 83
PORTABLE TAFFIC BARRIER STANCHION
Quantity - 4
Make - Lawrence Tensabarrier 889 Advance/Universal Base or equal
Size - 38-1/4" high post; 13-1/2" diameter base; 7'-6" maximum belt length
Description - Units shall be all standard construction with satin stainless steel finish, and retractable belts. Belt color shall be as selected by Architect from standard options.
Item 84
SOILED WARE TABLE W/ SINK & INTEGRAL PASS-THRU FRAME
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 9'-0" x 27" plus 51" x 30" return to warewasher, plus pass-thru x 34" high plus 10" high splash at walls; 3" high raised open roll on working faces; 48" x 49" pass thru with 35" sill height; 18" x 18" x 8" deep integral sink
Construction - 14 gauge stainless steel top, sink basin and splash, channel frame, nine legs with gussets, adjustable feet, and eight crossrails. Secure 3" off wall. Turn end down into dishwasher and secure with stainless steel machine screws. Top of splash shall be fitted with integral flat spot for mounting of the pre-rinse fixture. Top shall pass through the wall and be an integral part of the pass window. Pass-thru ledge shall extend through the wall and be secured to the frame. Provide a 16 gauge stainless steel telescoping window frame at the opening with front edges turned out 2" and returned 1/2". Rear edges to be turned out 2-1/2" flat to wall. Integral scrapping sink shall be provided with a 2" x 1/4" bar stock rack guide attached to the reinforced splash with stainless steel through bolts. Sink shall be provided with two 16 gauge perforated stainless steel scrapping baskets, 6" deep, on 1/2" high angle legs set back to clear the basin cove, and integral tubular handles flush with counter tops.
Accessories - Provide unit with a 2" free flow waste outlet Component Hardware D36-2080

Item 85
ROLL-DOWN SHUTTER
Make - Raynor DuraShutter Select/surface mount or equal by Alpine or Cornell
Size - Opening approximately 48" wide x 50" high; verify
Description - Assembly shall be all standard construction and shall consist of a self-coiling rolling counter shutter, all anodized aluminum construction with interlocking extruded slats, extruded aluminum bottom bar with rubber astragal, designed for surface type mounting with extruded guides with wool pile inserts, and complete with recessed inside lifting handles and thumb-turn locks, and complete covers.
Installation - Install with tracks located 1" clear above table surface to permit proper cleaning.

Item 86
HOSE REEL ASSEMBLY
Make - T&S Brass B-1457-7102-01C or equal by Fisher or Reel Craft
Size - 12 foot hose, 3/8" ID
Maximum Water Use - 1.07 Gallons per minute
Description - Unit shall be all standard construction with stainless steel open type reel, adjustable bumper, blue hose, B-107-J low flow spray valve, heat resistant spray valve handle, chrome risers, two wall brackets, continuous pressure vacuum breaker, 36" flexible water hose, control valve, and deck type base faucet, designed for wall mounting per plan up 8'-6" measured at the inlet.
Accessories - Provide with stainless steel pivoting wall bracket.
Installation - The hose reel bracket for wall mounted units shall be rotated 90° downward and installed such that it allows the hose to hang straight down and parallel to the wall. Refer to T&S Brass instructions manual page four figure one for further details.
Item 87
WARE WASHER
Make - Hobart CL44eN-BAS L-R*C166 or equal by Meiko or Stero
Size - 43-1/2 in. by 30-1/8 in. by 65-1/2 in. high
Power - 68 amps - 480/60/3 (common single point connection)
Conveyor speed - 5.6 feet per minute; 202 racks per hour
Maximum Water Usage - 0.62 gallon per rack
Certification - Unit shall be Energy Star compliant
Description - Unit shall be standard construction, double tank, fully automatic, rack conveyor type with 16 gauge stainless steel wash and rinse chambers, welded stainless steel frame and motor supports, stainless steel chambers, housing, insulated inspection doors and legs with adjustable feet. Conveyor structure, tracks, and drive unit to be all stainless steel with a conveyor speed of 5.6 feet per minute. Warewasher to be complete with with 30 KW booster heater, insulated cabinet style doors, dirty water indicator, configurable de-lime notification, top mounted computer controls with "start/stop" button and digital display, NSF approved pot and pan cycle mode, 19-1/2 in. standard chamber height, and and ten plastic racks.
Accessories - Provide with common single point connection for machine and booster, 30 KW internal booster heater, two standard vent hoods with 4 in. by 16 in. stainless steel stacks all welded water tight complete with locking dampers, higher than standard chamber to permit passage of racked 18 in. by 26 in. pans and trays, table limit switch, drain water tempering kit, and four plastic peg racks and two plastic flat racks.

Item 88
STAINLESS STEEL EXHAUST DUCT
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 4" x 16" with length as necessary to reach 3" above finished ceiling
Construction - 18 gauge stainless steel welded exhaust ducts, sized to suit the vent stacks. Ducts shall be provided with a one-piece perimeter angle collar at the ceiling, installed "leg up".

Item 89
CLEAN WARE TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 63" x 30" x 34" high plus 10" splash at rear; 3" high raised roll at front and end
Construction - 14 gauge stainless steel top and splash over channel frame with raised roll front and end, tall splash at rear, turned down into dishwasher and secured with stainless steel machine screws, and mounted on four legs with gussets, adjustable feet and undershelf. Secure table 3” off face of wall.

Item 90
No item
Item 91
UTILITY CART
Quantity - 4
Make - Lakeside 521 or equal by Kelmax or Channel
Size - 32-5/8" x 19-3/8" x 34-1/2"
Description - Cart shall be all standard NSF construction, stainless steel throughout, with top and bottom shelves supported by an angle frame, and mounted on two 8" fixed and two 5" swivel casters. Capacity of cart to be 650 pounds.

Item 92
MOBILE SHELVING UNIT, FOUR-TIER
Quantity - 5
Make - MetroMax Q*C166 or equal by Cambro or Fermod
Size - (6) 48" x 21" and (2) 36" x 21", all 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 93
THREE-COMPARTMENT SINK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 10'-0" x 30" x 34" high plus 10" high splash at wall; 3" high raised open roll on three sides; three 21" x 27" x 12" deep integral sink basins
Construction - 14 gauge stainless steel drainboards, basins and splash, stainless steel channel reinforced, mounted on four legs with gussets, adjustable feet, three lengths of crossrail, and secured 3" off face of wall.
Accessories - Two pot sink faucet sets, three 2" lever waste outlets.

Item 94
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 5'-0" x 10" mounted 1" off face of wall up 54" above finished floor

Item 95
No item

Item 96
No item

Item 97
No item
Item 98
No item

Item 99
No item

Item 100
No item

Item 101
REFRIGERATOR, REACH-IN
Make - Victory RSA-2D-S1-EW-HD-HC, or equal by Continental
Size - 58-3/8 in. by 35 in. by 84-1/4in. high overall
Power - 6.5 amps - 1/3 HP - 120/60/1 - cord and plug
Doors - Half height, standard hinging
Certification - Unit shall be Energy Star compliant
Description - Refrigerator shall be all standard construction with stainless steel exterior, aluminum interior, self-closing door hardware with a hold-open at 120°, Humidity control wires around the door jamb, automatic LED interior lighting, exterior digital thermometer, heavy duty epoxy plated wire shelves adjustable in one inch increments, self-contained top mounted refrigeration system capable of maintaining a 33° to 38° temperature range with Secure-Temp 1.0 temperature monitoring technology, R-290 refrigerant, and condensate evaporator.
Accessories - Mount on 6” high casters.

Item 102
FREEZER, REACH-IN
Make - Victory FSA-2D-S1-EW-HD-HC, or equal by Continental
Size - 52-1/8 in. by 35 in. by 84-1/4 in. high overall
Power -10.5 amps - 3/4 HP - 120/60/1 - cord and plug
Capacity - 49.02 cubic feet
Doors - Half height, standard hinging
Certification - Unit shall be Energy Star compliant
Description - Freezer shall be all standard construction with stainless steel exterior, aluminum interior, self-closing door hardware with a hold-open at 120°, anti-condensate door perimeter heaters, automatic LED interior lighting, exterior digital thermometer, silver freeze coated wire shelves adjustable in one inch increments, self-contained top mounted refrigeration system capable of maintaining a -10° product temperature range with Secure-Temp temperature monitoring technology R-290 refrigerant, and condensate evaporator.
Accessories - Mount on 6” high casters.

Item 103
MOBILE SHELVING UNIT, FOUR-TIER
Make - MetroMax Q*C166 equal by Cambro or Fermod
Size - 36" x 24" x 69" high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection,
supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5" diameter polyurethane tired swivel casters with donut bumpers.

Accessories - Provide with polymer posts in lieu of standard.

Item 104
STACKED CLOTHES WASHER/DYER
Make - UniMac UTEE5AS17STW01 or equal Wascomat or Speed Queen
Size - 27" x 27-3/4" x 78-3/16" high
Power - 30 amps circuit - 120/240/60/1 - cord and plug (NEMA 14-30P);
20 amps circuit - 120/60/1 - cord and plug (NEMA 5-15P)
Exhaust - 4" diameter dryer vent
Maximum Water Use - Less than 3.7 gallons/ft3/cycle
Certification - Unit shall be Energy Star compliant and CEE qualified.
Description - Washer shall be all standard construction with white exterior, see-thru door with heavy duty stainless steel hinge, 3.42 cubic foot front loading basket, detergent dispensers, front panel control, three wash/rinse temperatures, and five selectable wash cycles. Dryer shall be all standard construction with white exterior, see-thru door with heavy duty stainless steel hinge, lint filter, and interior light.

Item 105
WARE WASHER
Make - Hobart LXeH*C166 or equal by Meiko or Stero
Power - 30.5 amps - 120/208/60/1 - cord and plug (NEMA 14-50P)
Certification - Unit shall be Energy Star compliant
Description - Dishwasher shall be all standard stainless steel construction with 17" high load capacity, twin upper and lower wash/rinse arms, 38 GPM pump, integral 4.9 KW hot water booster, top mounted microcomputer controls, 109 second cycle complete with pumped rinse, 1.8 KW tank heat, two racks, pumped drain, door interlock switch, automatic fill and digital thermometer and cord and plug kit. Mount in place and secure with stainless steel angles to the underside of the counter.

Accessories - Provide unit with cord and plug kit and drain water tempering kit.

Item 106
PRE-RINSE SPRAY WITH ADD-ON FACUET
Make - T&S Brass B-0287*C166
Description - Pre-rinse sprayer shall be all standard construction with splash mounted mixing body, four-arm color coded handles, tubing riser, spring action gooseneck, wall bracket, a B-107-J water saver pre-rinse spray and B-0286- LNEZ big-flow add-on faucet.

Item 107
THREE-COMPARTMENT SINK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 9'-3" x 27-1/2" x 34" high plus 10" high x 2" thick splash at wall; 3" high raised open roll on three sides; three 18" x 27" x 12" deep integral sink basins
Construction - 14 gauge stainless steel drainboards, basins and splash, stainless steel channel reinforced, mounted on four legs with gussets, adjustable feet, and three lengths of crossrail. Secure to wall and seal.

Accessories - Pot sink faucet set, three 2" lever waste outlets.

Item 108
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 54" x 10" mounted 1" off face of wall up 54" above finished floor

Item 109
WASTE BIN
No work in this Section. Item to be provided by Owner.

Item 110
ADA HAND SINK
Make - Advance 7-PS-25 modified or equal by Eagle or Krowne
Size - 20 in. by 24 in. by 13 in. high overall, 14 in. by 16 in. x5 in. deep sink bowl
Description - Unit shall be all standard stainless steel construction with wall mounting bracket. Mount on wall with rim at 34 in. above floor. Modify faucet holes to be two holes spaced 8 in. apart on center. Delete standard faucet.
Accessories - Deck mounted soap dispenser, 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap. Provide stainless steel end splash welded to left side.

Item 101a
FAUCET
Make - T&S Brass B-0322-04 modified or equal by Fisher or Encore
Description - Unit shall be all standard construction with deck mounted mixing body, 8" center inlets, and wrist blade handles. Modified unit shall be provided with B-0199-02F-12 aerator tip in lieu of the standard.

Item 111
No item

Item 112
No item

Item 113
DRY STORAGE SHELVING
Quantity - 3
Make - Metro Super Adjustable Super Erecta or equal by Nexel
Size - (2) 48" x 21" and (1) 36" x 21", all 74-5/8" high; five tier with bottom shelf up 14" clear above floor
Description - Unit shall be all standard construction with Super Adjustable Chrome plated wire shelves and tubular steel uprights with capped tops, adjustable feet, and 1" shelf height adjustment capability with Corner Release System. Each unit shall include four legs.

Item 114
MOBILE WORK TABLE
Quantity - 4
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 48" x 30" x 36" high
Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5" diameter swivel casters, two with brakes, and full undershelf.

Accessories - Drawer assembly.

Item 115
WORK TABLE
Quantity - 4
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 18" x 33" x 36" high plus 6" high rear splash
Construction - 14 gauge stainless steel top and splash over angle frame with three edges formed in turndown and rear formed in short splash with finished exterior, mounted on four legs with gussets, adjustable feet and full undershelf.

Item 116
FOUR-BURNER RANGE WITH OVEN
Quantity - 4
Make - Vulcan 24S-4BN*C166 or equal by Southbend
Size - 24" x 32" x 37" high to work surface; 47" high overall
Rating - 3/4" gas inlet at 143,000 BTU/hour

Description - Range shall be all standard construction with fully welded aluminized steel frame, four 30,000 BTU/hour open burners with one pilot lights for every two burners, level cast iron removable grates, stainless steel front, sides, and back riser, 20-1/4" x 26" x 14-1/2" high thermostatically controlled 23,000 BTU/hour oven with two racks and safety pilot, full width pull-out crumb tray below burners, and provided with pressure regulator.

Accessories - Provide with Flame Safety device with manual spark ignition for all open top burners, and oven pilot. Provide a 10" high stainless steel flue riser. Mount unit on 5" diameter heavy duty swivel casters, two with brakes. Provide assembly with a 36" long x 3/4" line size Dormont 1675 KIT2S plastic covered hose assembly with full port gas ball valve, two Supr-Swivels, brass disconnect, 90° street elbow and restraining cable. Mount the nipple on the rear of the oven, and the hose assembly with disconnect device connected to the building supply line.
Item 117
WORK TABLE
Quantity - 2
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 30” x 33” x 36” high plus 6” high rear splash
Construction - 14 gauge stainless steel top and splash over angle frame with three edges formed in turndown and rear formed in short splash with finished exterior, mounted on four legs with gussets, adjustable feet and full undershelf.

Item 118
STAINLESS STEEL UTILITY CHASE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 6" x 6" x height to reach 3" above finished ceiling
Construction - Chase shall be fabricated of 16 gauge stainless steel channels per detail with full height exposed channel, partial height infitting rear channel and tack welded in place, and a removable channel extending from 14" above floor to 78" above floor. Bottom shall be provided with an integral sloped plate at 30° to horizontal and shall be provided with a leg fabricated of 2" square stainless steel tubing with flanged adjustable foot. Removable rear panel shall be installed following the completion of gas and water piping and shall be held in place with six minimum stainless steel machine screws. Secure to structure above ceiling and to the side of Item 120.

Item 119
EXHAUST VENTILATOR
Make - CaptiveAire 5424 ND-2 (DWG# 4949718) or equal by Gaylord or Halton
Size - 8'-6" plus 12" utility cabinet at right end x 54" x 24" high plus 4" high collars, joined back-to-back with Item 120, mounted up 6'-8" above finished floor; flat bottom
Power - Power to lights from Item 122
Exhaust - 1,912 CFM thru a 14" diameter collar @ -0.786" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.
Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edge with integral front baffle, double sidewall construction, and NSF Listed. Unit shall have grease collection trough, storage container, and hanger brackets. Provide with UL Listed stainless steel baffle type extractors. Provide all materials necessary for the hanging of the ventilator.
Accessories - Provide with four UL Listed recessed LED light fixtures, factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3 in. above finished ceiling to close to adjacent surfaces on three sides. Provide with balancing damper, one filter removal tool, and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.
Item 120
EXHAUST VENTILATOR
Make - CaptiveAire 5424 ND-2 (DWG# 4949718) or equal by Gaylord or Halton
Size - 8'-6" plus 12" utility cabinet at left end x 54" x 24" high plus 4" high collars, joined back-to-back with Item 119, mounted up 6'-8" above finished floor; flat bottom
Power - Power to lights from Item 122
Exhaust - 1,912 CFM thru a 14" diameter collar @ -0.786" static pressure. Blower and ductwork provided and installed by Ventilation Contractor.
Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edge with integral front baffle, double sidewall construction, and NSF Listed. Unit shall have grease collection trough, storage container, and hanger brackets. Provide with UL Listed stainless steel baffle type extractors. Provide all materials necessary for the hanging of the ventilator.
Accessories - Provide with four UL Listed recessed LED light fixtures, factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3 in. above finished ceiling to close to adjacent surfaces on three sides. Provide with balancing damper, one filter removal tool, and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 121
FIRE SUPPRESSION SYSTEM
Make - Ansul R-102
Protection for hoods: 119 and 120
Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted in the hood manufacturer provided utility cabinet and piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel or chrome and limited to vertical drops only. Horizontal piping shall be run over the ventilator's top. Nozzles shall be swivel type with metal caps. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide a properly sized mechanically operated gas shut-off valve (up to 3" diameter) for mounting by the Plumber at a point in the gas supply that will shut off fuel to all gas fired equipment. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a recessed junction box mounted for installing the pull box with cable conduit concealed within walls. Provide system with class-K extinguisher as required.
Workmanship - Exposed stainless steel fittings and piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. Chrome sleeves are not acceptable.
Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.

Accessories - Provide swivel type nozzles with metal caps

Item 122
VENTILATOR DEMAND CONTROL SYSTEM
Make - CaptiveAire DCV-1011 (DWG# 4949718) or equal by Gaylord or Halton
Power - 20 amps circuit - 120/60/1 to logic controller
Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturer’s shop drawings. The system shall include programmable logic controller (PLC), variable frequency drive (VFD), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Items 119 and 120. Mount LCD screen control, recessed and flush to wall per plan 60” above floor. Mount LCD screen control in a recessed junction box provided by the General Contractor. Mount system processor in the cabinet mounted on the right end of exhaust ventilator 119. Mount the room air temperature sensor on the wall 66” above the finished floor.

Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the DCV hood system. Submittal shall list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.

Accessories - Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturer’s service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration. Provide BacNet monitoring system.

Item 122a
DEMAND CONTROL SYSTEM INTERFACE SCREEN
Specified as part of Item 112

Item 122b
ROOM TEMPERATURE SENSOR
Specified as part of Item 112

Item 123
No item

Item 124
No item
Item 125
WALL CABINET WITH HINGED DOORS
Quantity - 4
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 36" x 15" x 24" high at front face; 28" high overall; mount 18" above countertop
Construction - 18 gauge stainless steel body and shelves, adjustable intermediate shelf, hinged door front with full height vertical fold pull, and sloped top.

Item 126
WORK COUNTER WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 17'-0" x 30" plus a 48" x 30" extension x 34" high plus 6" high splash at walls; 18" x 20" x 10" deep integral work sink basin; 20" x 18" x 6-1/2" deep integral accessible sink basin (offset drain to left end)
Construction - 14 gauge stainless steel top, sink basins, and splash over angle frame, front and exposed end formed in turndown, rear and right end formed in short splash, twelve legs with gussets, adjustable feet, three crossrails and two partial undershelves. Secure to walls and seal.
Accessories - Provide standard work sink with a deck mount faucet and 2" lever waste outlet. Provide accessible work sink with a T&S Brass B-0323-04 faucet, or equal by Fisher or Encore, with 6" wrist blade handles, and crumb cup waste outlet.

Item 127
WORK COUNTER WITH SINKS
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 17'-10" x 30" plus a 48" x 30" extension x 34" high plus 6" high splash at walls; 18" x 20" x 10" deep integral work sink basin; 20" x 18" x 6-1/2" deep integral accessible sink basin (offset drain to right end)
Construction - 14 gauge stainless steel top, sink basins, and splash over angle frame, front and exposed end formed in turndown, rear and right end formed in short splash, twelve legs with gussets, adjustable feet, three crossrails and two partial undershelves. Secure to walls and seal.
Accessories - Provide standard work sink with a deck mount faucet and 2" lever waste outlet. Provide accessible work sink with a T&S Brass B-0323-04 faucet, or equal by Fisher or Encore, with 6" wrist blade handles, and crumb cup waste outlet.

Item 128
STAINLESS STEEL WALL OVEN CABINET
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 33" x 30" x 84" high
Construction - 18 gauge stainless steel cabinet body with fixed bottom shelf at base cabinet with adjustable intermediate shelf, double pan concealed hinge doors at front with full width horizontal top pull, slide out shelf below wall oven insert, slide out landing shelf below wall oven insert,

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oven insert with full width horizontal pull, upper cabinet with fixed bottom shelf and adjustable intermediate shelf, double pan concealed hinge doors at front with full height vertical pulls. The entire assembly shall be mounted on 6" high adjustable legs with adjustable feet. Provide two-piece adjustable stainless steel angle kick on front and exposed, with one angle mounted to bottom under the base and second angle to extend to floor to eliminate gaps due to uneven floors. Refer to wall oven installation instructions for additional details. If plywood support backing is required, the plywood shall be marine grade and completely concealed.

Item 129
WALL OVEN
No work in this Section. Item to be provided and installed by General Contractor.

Item 130
MOBILE DEMONSTRATION COUNTER WITH MIRROR
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 48" x 30" x 36" high to counter top; 24" x 48" mirror up 84" measured on centerline
Construction - 14 gauge stainless steel top over angle frame with all edges formed in turndown, mounted on a stainless steel cabinet base of box type construction with bottom and intermediate shelf and mounted on 5 in. diameter swivel casters, two with brakes. Front shall be provided with two double pan stainless steel doors with lock and horizontal folded top pull. Mirror shall consist of 1/4 in. plate glass with mirror backing mounted in an 18 gauge stainless steel pan with stainless steel angle perimeter retainer trim. Mirror shall be supported on a full width stainless steel shaft of rod stock on its horizontal centerline with appropriate clamps to the frame and passing through the uprights. Both sides shall be fitted with a flag type adjustment bracket with slotted hole permitting adjustment from 30 degrees from horizontal to 60 degrees from horizontal as a minimum, and stainless steel 3/8 in.-16 securing bolts passing through the leg and fitted with washers and stainless steel wing nuts. Uprights shall be 1-5/8 in. stainless steel tubing with welded capped tops, drilled holes to receive the mounting shaft and securing bolts. Uprights shall pass through tight swedged openings in the top and secured to cabinet interior intermediate shelf with concealed fasteners to provide necessary rigidity. Ends of the support shaft shall be fitted with washers and pins to secure the mirror in the uprights.

Item 131
BEVERAGE TABLE
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, LTI, or SML Stainless Steel Group
Size - 60" x 24" x 36" high plus 6" splash at wall
Construction - 14 gauge stainless steel top over angle frame with three edges formed in turndown and rear formed in short splash, mounted on four legs with gussets, adjustable feet and full undershelv.

Item 132
COAT RACK, WALL MOUNT
No work in this Section. Item to be provided and installed by General Contractor.
Item 133
STORAGE CUBBIES
Quantity - 8
No work in this Section. Item to be provided and installed by General Contractor.

PART 3 - EXECUTION

3.1 SANITATION REQUIREMENTS

A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation will be referred to the State Department of Health for a ruling.

B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.2 EXAMINATION AND ACCEPTANCE

A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.

B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work will be construed as acceptance of space conditions.

C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.

D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.3 CLEANING UP

A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.

B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.
3.4 DEMONSTRATION AND OPERATING INSTRUCTIONS

A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.

B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.

C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Provide with a list of equipment to include make, model, and serial number where applicable. Book shall be turned over to Owner after review and approval.

D. Submit guarantees and warrantees to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.5 PROTECTION OF WORK

A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.

B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.

C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by the Architect.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section includes wet-pipe sprinkler system, system design, installation, and certification.

B. Related Sections:
   1. Section 21 05 00 - Common Work Results for Fire Suppression: Product and execution requirements for pipe, fittings, valves, hangers, supports, identification and painting for placement by this section.
   3. Section 21 05 48 - Vibration and Seismic Controls for Fire-Suppression Piping and Equipment: Product and installation requirements for vibration isolators used in piping systems.
   4. Section 21 30 00 – Fire Pumps.
   5. Section 22 04 00 – General Conditions for Fire Suppression Trades
   6. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.02 REFERENCES

A. National Fire Protection Association:
   2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
   4. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

B. Factory Mutual:
   1. FM - Factory Mutual Approval Guide.

C. Underwriters Laboratory:
   1. UL - Fire Resistance Directory.

1.03 SYSTEM DESCRIPTION

A. This project comprises alterations and renovations to the existing sprinkler system. The contractor shall field verify all existing conditions prior to submitting shop drawings including but not limited to, location of the existing sprinkler heads, locations and sizes of existing sprinkler piping, and available static pressure, residual pressure and flow at the base of the riser. Contractor shall make revisions to sprinkler piping as required to support the new layout of sprinkler heads, including revising sizes of existing piping.
B. Provide a wet pipe system hydraulically designed in accordance with NFPA 13 and all requirements of the local Authority Having Jurisdiction.

C. System to provide coverage for building areas noted.

D. Provide system to NFPA Standard occupancy requirements as noted on the drawings.

E. Hydraulic data and water supply information shall be as noted on the drawings.

F. Interface system with building fire alarm system.

G. The sprinkler locations and piping arrangements indicated on the contract documents are diagrammatic. It is the responsibility of the contractor to fully coordinate sprinkler and piping locations with all other trades. The Contractor shall field verify all existing conditions. If it is determined by the contractor that the existing swing joint assemblies are supplied by ½” tee outlets contractor shall inform Architect/Engineer immediately for direction on how to proceed with work.

H. Sprinkler locations indicated on the Contract Documents indicate sprinkler coverage utilizing standard coverage sprinklers maximum 225 square feet per sprinkler for light hazard and 130 square feet per sprinkler for ordinary hazard. Extended coverage sprinklers shall not be installed in any locations unless specifically indicated on the Contract Document drawings.

I. All sprinklers installed in a light hazard classification occupancy shall be a listed quick response type.

J. Provide fire department connections as indicated on Drawings.

1.04 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Where the terms “authorities having jurisdiction” is used, within this Specification, it is intended to include the Insurance Underwriter and all regulatory agencies having vested interest in this project.

C. Shop Drawings:
   1. Provide fire protections shop drawings drawn to a minimum scale of ¾”=1’-0”. Shop drawings shall be in accordance with the requirements of NFPA 13. Indicate pipe materials used, joining methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
   2. Provide hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls.
   3. All sprinkler drawings and calculations shall bear the seal of a Professional Engineer licensed in the State where the project is located. Seal and
signature shall not be copied and shall be provided as an original on drawings and each calculation.

4. Sprinklers shall be as shown on drawings and submittals and shall be specifically identified with the applicable style or series designation as published in the appropriate agency listing or approval. Trade names or other abbreviated designations are not permitted.

D. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

E. After successful review by the Engineer, submit sprinkler layout shop drawings, product data, and hydraulic calculations to authority having jurisdiction, Fire Marshall, and Owner’s insurance underwriter for approval. Submit proof of approval to Architect/Engineer.

F. Grooved joint couplings and fittings shall be shown on shop drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.

G. Manufacturer’s Certificate: Certify that system has been tested and meets or exceeds specified requirements and all code requirements.

1.05 CLOSEOUT SUBMITTALS

A. Division 01 – General Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.06 QUALITY ASSURANCE

A. Workmanship and Qualifications: All materials and equipment shall be installed in accordance with NFPA and all applicable local codes and ordinances. The Sprinkler Contractor shall be state licensed to install sprinkler systems. The Sprinkler Contractor shall make sure that all work and materials conform to the requirements set forth by this Specification. Fire protection equipment shall be installed to conform to NFPA as applicable, and devices used shall be listed and approved by Underwriters laboratories (UL) and/or Factory Mutual (FM).

B. Codes and Standards: All work shall be equal or superior to that required by codes, regulations, ordinances, and laws imposed by the jurisdictional authorities, including those of state codes, the State Fire Marshall, local ordinances and OSHA. Nothing in the Specifications permit violations of such directives, and where conflict occurs, the directive shall govern, except where superior work is specified or indicated.
C. In addition to complying with the above codes and regulations, comply with the requirements of the following:
   4. Local Jurisdictional Authorities.

D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

E. Valves: Bear UL and/or FM label or marking. Provide manufacturer’s name and pressure rating marked on valve body.

F. All items of similar class shall be the products of the same manufacturer. All valves, accessory items, etc., shall be from the same source.

G. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

H. Installer: Company specializing in performing work of this Section with minimum five years experience.

I. Design sprinkler system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State where the project is located.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.08 PRE-INSTALLATION MEETINGS

A. Division 01 – General Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver and store products in shipping containers, with labeling in place.
C. All equipment, valves, gages and etc., shall be covered and protected during the execution of the work. All equipment and piping shall be protected from freezing. Labeling to remain in place.

D. All unloading, hauling, and handling of materials shall be the responsibility of the Sprinkler Contractor.

E. The Sprinkler Contractor can obtain information on available storage space on site from the Owner when making examination of the site.

1.10 WARRANTY

A. Division 01 – General Requirements: Product warranties and product bonds.

1.11 EXTRA MATERIALS

A. Division 01 – General Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Provide metal storage cabinet adjacent to the sprinkler riser.

PART 2 PRODUCTS

2.01 SPRINKLERS

A. Manufacturers:
   1. Viking.
   2. Tyco.
   3. Victaulic.
   4. Grinnell Corp.
   5. Reliable Sprinkler Corp.
   6. Substitutions: Division 01 – General Requirements

B. All sprinklers shall be adjustable, glass bulb, automatic sprinklers with ½ inch orifice and 5.6 K-factor unless noted otherwise. Type of sprinkler head shall be as indicated on the plans and in accordance with the following.

C. Sprinkler bodies shall be die-cast brass, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.

D. Unless noted otherwise, ordinary temperature rated sprinkler heads shall be used throughout the building.
E. Where sprinklers will be installed in close proximity to heat sources and special locations, as identified in NFPA 13, temperature ratings shall be in accordance with the requirements of NFPA 13.

F. Where plans call for extended coverage sprinkler heads coordinate coverage requirements with required pressure and K-factor.

G. Spare Sprinklers: The Sprinkler Contractor shall furnish spare automatic sprinklers in accordance with the requirements of NFPA for stock of extra sprinklers. The sprinklers shall be packed in a suitable container and shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. The Sprinkler Contractor shall furnish no less than two special sprinkler wrenches, or at least one wrench for each container or sprinkler box, whichever is greater.

H. In areas where sprinkler heads are subject to physical damage, provide sprinkler guard assembly over head, finish to match sprinkler finish. This shall include but not limited to the following locations:
   1. Heads in elevator shafts.
   2. Heads under lower rakes of stairways.
   3. Heads in electrical rooms, boiler rooms and other mechanical rooms.
   4. Heads installed 7'-0" or less above finished floors.
   5. Heads in gymnasium/fitness center areas.

I. Sprinklers shall be in accordance with the schedule indicated on the plans.

2.02 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A53, ASTM A795 or ASTM A135; Schedule 40 carbon steel. Schedule 10 pipe shall be allowed for pipe sizes 1 ¼" diameter and larger when roll grooved mechanical couplings are used.
   1. Fittings:
      c. Grooved Mechanical Fittings: ANSI A21.10/AWWA C-110 ductile iron; ASTM A536 Grade 65-45-12 ductile iron; ASTM A234 Grade WPB; or factory fabricated from carbon steel pipe conforming to ASTM A53; with grooves or shoulders designed to accept grooved end couplings. Fittings shall be of the same manufacturer as the adjoining couplings. Grooved Mechanical Couplings: ASTM A536 Grade 65-45-12, ductile iron housing, elastomer gasket with nuts and bolts to secure roll grooved pipe and fittings.

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<tr>
<th>Fire Protection Service</th>
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<td>Dry Systems</td>
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WET-PIPE SPRINKLER SYSTEMS
21 13 13 – 6
PROJECT No. 056-0052 A / 01/07/2022
Freezer Applications | -40°F to 0°F | FlushSeal®, Grade L, Silicone
Water/Wet Systems | Ambient | C-Shape or EZ Style 009

1) Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13.
   a) 1-1/4” through 4”: Factory assembled for direct stab installation without field disassembly. Victaulic Style 009 EZ.
   b) 5” through 8”: Victaulic FireLock™ Style 005.
   c) 10” and larger: Victaulic Zero-Flex® Style 07.

2) Flexible Type Couplings: Use in locations where vibration attenuation and stress relief are required, and for seismic considerations in accordance with the manufacturer’s instructions. Victaulic Style 75.

B. Copper Tubing: ASTM B75; ASTM B88; or ASTM B251; Type [L] [K], hard drawn, seamless.
   1. Fittings:
      a. ANSI/ASME B16.18, cast copper alloy pressure fittings, or ANSI/ASME B16.22, wrought copper and copper alloy solder joint pressure fittings.
   2. Joints:
      a. [ASTM B32, solder, Grade 95TA] [ANSI/AWS A5.8 BCuP silver braze].
      b. Grooved Mechanical Couplings: ASTM A536 Grade 65-45-12, ductile iron housing, FlushSeal® or QuickVic elastomer gasket with nuts and bolts to secure roll grooved pipe and fittings. Housings cast with offsetting, angle-pattern bolt pads to provide rigidity, and manufactured to connect copper tubing and fittings without flaring. Victaulic Style 606 or Style 607 “QuickVic” stab-on couplings.

2.03 OUTLET FITTINGS

A. Rubber-gasketed outlet fittings that are used on sprinkler systems shall meet the following requirements:
   1. Be installed in accordance with the listing and manufacturer’s installation instructions
   2. Have all disks retrieved
   3. Have smooth bores cut into the pipe, with all cutting residue removed
   4. Not be modified

2.04 UNIONS AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches (50 mm) and Under:
   1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.
B. Dielectric Connections: Union, waterway fitting, or flange with water impervious isolation barrier; Victaulic Style 47 or Watts 3000 Series or approved equal.

2.05 PIPE HANGERS AND SUPPORTS

A. Conform to NFPA 13.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

G. Vertical Support: Steel riser clamp or Angle ring.

H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.06 VALVES

A. Manufacturers:
1. Kennedy.
2. Fairbanks.
4. Victaulic.
5. Nibco.

B. Butterfly Valves:
1. Ductile iron body, ductile iron disc with EPDM disc coating and integrally cast stem, grooved ends.
2. Cast bronze body, ductile iron disc with EPDM disc coating and integrally cast stem, copper-tubing dimensioned grooved ends.
3. Cast iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck with 316 stainless steel stem, MSS-SP-67, 200 psi.
4. Disc: EPDM coated ductile iron or Aluminum bronze.
5. Operator: Notched plate lever handle, Handwheel and Weatherproof Actuator with supervisory switches.

C. Check Valves:
1. Up to and including 2 inches: Class 125, Bronze swing disc, screwed ends.
2. Horizontal Swing Over 2 inches:
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

a. 300 psi CWP, ductile iron body and coupled cap conforming to ASTM A536, Grade 65-45-12; horizontal swing, with stainless steel disc, elastomer seat, and grooved ends.

b. Class 175, cast iron body and bolted cap conforming to ASTM A126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends.

c. Valve shall be capable of being refitted while the valve remains in line.

3. Spring Actuated Over 2 inches:
   a. 300 psi CWP, ductile iron body conforming to ASTM A536, Grade 65-45-12; vertical or horizontal check; with stainless steel spring and shaft.
      1) 2-1/2 (65 mm) and 3 inches (75 mm): Aluminum bronze disc with disc mounted elastomer seal and PPS (Polyphenylene Sulfide) coated seat.
      2) 4 inches (100 mm) and Larger: Elastomer coated ductile iron disc with welded-in nickel seat.

D. Pressure reducing Valve: [Angle] [Straight away] type; brass with chrome plated finish with inner hydraulic controls. 1-1/2 inch size, fire department thread, [400 psi inlet pressure, with threaded cap and chain of chrome plated finish.

2.07 PIPING SPECIALTIES

A. Manufacturers:
   1. Potter.
   2. Potter-Roemer.
   4. Victaulic.
   5. Viking.
   6. [______________].

B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two form C contacts; rated 10 amp at 120 volt.

C. Valve Tamper Supervisory Switch: Two form C contacts; rated 10 amp at 120 volt. UL listed and FM approved. Up to 2” – Potter Model PCVS-1. Over 2” switch shall be Potter Model OSYSU-2.

D. Pressure Switch: ½ inch male pressure connection to alarm valve riser and actuated by any flow of water in excess of one sprinkler. Maximum pressure rating 175 psi, weather-proof with tamper resistant screws, rated 10 amps at 120 volt.

E. Pressure Gage: Rated for 300 psi use, 3-1/2” in diameter.
PART 3 EXECUTION

3.01 PREPERATION

A. Coordinate work of this Section with other affected work.

B. Prepare piping connections to equipment with grooved joint couplings, flanges, or unions.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer’s instructions.

B. Install fire protection systems in accordance with NFPA 13 for sprinkler systems.

C. Impairments to the existing water supplies shall be minimized. All work shall be complete before making the final connections to the existing water supplies. The Contractor shall notify the owner’s representative before impairing any fire protection equipment.

D. The Contractor shall maintain a clean and orderly site during the installation of the sprinkler system. Materials shall not be stored in the halls or other public areas.

E. Cutting, welding and other hot work shall not be permitted without permission from the building owner. Contractor shall provide a fire watch for one hour after all welding.

F. Center heads in two directions in ceiling tile and provide piping offsets as required.

G. Sprinkler Bulb protector must remain in place until the sprinkler is completely installed. Remove the bulb protector by hand after installation and before the system is placed in service. (Do not use any tools to remove the bulb protector.)

H. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

I. Coordinate flow switches, tamper switches, and all other sprinkler devices with the fire alarm system.

J. Provide wire guards on sprinklers as indicated on drawings.

K. Place pipe runs to minimize obstruction to other work.

L. Install piping in concealed spaces above finished ceilings.

M. Pipe and fitting shall be installed per the manufacture’s installation requirements. The fire protection contractor shall furnish all materials necessary to meet these requirements including but not limited to hangers, support, insulation, shields, sleeves and power supplies.
N. Hydrostatically test entire system in accordance with the requirements of NFPA 13 2013.

O. Require test be witnessed by Authority having jurisdiction.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.04 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.05 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

3.06 IDENTIFICATION

A. Provide and apply signs to control, drain, test and alarm valves to identify their purpose and function.

B. Provide and permanently attach hydraulic calculations data nameplate at the controlling valve for the sprinkler system. Provide lettering size and style from NFPA’s suggested styles.

3.07 TESTING

A. Section 21 05 00 - Common Work Results for Fire Suppression.

END OF SECTION
PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 22, "Plumbing" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Food Service, Structural, Landscape, Civil, Mechanical, Fire Protection and Electrical) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.02 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.03 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice
even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.04 DEFINITIONS

A. “Approved equal” also known as “alternative” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

B. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. “Finished” refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

E. “Furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. “Install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.
H. "Lead Free" shall mean not more than .25% in the wetted surface area.

I. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

J. “Product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

K. “Provide” shall mean furnish (or supply) and install as necessary.

L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

M. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

N. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

O. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

P. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

Q. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

R. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.05 CONTRACT DOCUMENTS

A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.

B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for
exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

1.06 DISCREPANCIES IN DOCUMENTS

A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.

C. Where Drawings or Specifications do not coincide with manufacturers’ recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.

D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.

E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect’s attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.
1.07 SURVEYS AND MEASUREMENTS

A. Before submitting the Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions made, any omissions or errors made as a result of their failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.08 CODES AND STANDARDS

A. Reference Standard Compliance

1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.

2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Wherever Codes and/ or standards are mentioned in these specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.
C. The following Standards shall be used where referenced by the following abbreviations:

ACGIH  American Conference of Governmental Industrial Hygienists
AGA    American Gas Association
AIA    American Institute of Architects
ANSI   American National Standards Institute
API    American Petroleum Institute
ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME   American Society of Mechanical Engineers
ASPE   American Society of Plumbing Engineers
ASSE   American Society of Sanitary Engineers
ASTM   American Society of Testing and Materials
AWS    American Welding Society
AWWA   American Water Works Association
CGA    Compressed Gas Association
CSA    Canadian Standards Association
CISPI   Cast Iron Soil Pipe Institute
EJMA   Expansion Joint Manufacturing Association
EPA    Environmental Protection Agency
FM     Factory Mutual
FSSC   Federal Specification
HIS    Hydraulic Institute Standards
IEEE   Institute of Electrical and Electronics Engineers
IRI    Industrial Risk Insurers
D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.09 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all
necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.10 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an “approved equal” alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non-approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer’s equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.
F. Equipment, material or devices submitted for review as a “substitution” shall meet the following requirements:

1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
   a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution's effect on the Contractor’s Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   f. Cost information, including a proposal of the net change, if any in the Contract Sum.
   g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become
necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.11 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 01 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.

1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.

2. If an intermediate submittal is necessary, process the same as the initial submittal.

3. Allow ten business days for reprocessing each submittal.

4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.

1. Include the following information on the label for processing and recording action taken.
   a. Project name.
   b. Date.
   c. Name and address of Engineer.
   d. Name and address of Contractor.
   e. Name and address of subcontractor.
   f. Name and address of supplier.
   g. Name of manufacturer.
   h. Number, title and paragraph of appropriate Specification Section.
   i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for
data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.

1.12 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated plumbing layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Plumbing Contract.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers' names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, i.e. HVAC, plumbing, fire protection, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.
F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. “No Exception Taken” rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.

I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.13 COORDINATION DRAWINGS AND BIM MODEL

A. Coordination drawings are required for all fire protection, plumbing, mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the plumbing and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.

B. Prepare coordination drawings in accordance with Division 01 to a minimum scale of 1/4”=1'-0” detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:
a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

b. Equipment connections and support details.

c. Exterior wall and foundation penetrations.

d. Fire-rated wall and floor penetrations.

e. Sizes and locations of required concrete pads and bases.

C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor’s use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section.

I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.
1.14 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a “Request for Information” (RFI).

F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.
1.15 QUALITY CONTROL

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of plumbing systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.16 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.
1.17 TEMPERATURE UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

H. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of
the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.18 EQUIPMENT ACCESS

A. Appliances, controls devices, valves and accessories that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide shall be provided in front of the control side to service an appliance.

1.19 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.20 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or tradespeople and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.
1.21 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.22 CLEANING

A. The Contractor shall thoroughly clean and flush all piping and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.
2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.


F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner’s property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.23 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days’ notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; controls, water heaters, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on USB Flash drive and turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.
1.24 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 01 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing and operating instructions including lubrication charts and schedules.
5. Emergency and safety instructions.
6. Spare parts list.
8. Wiring diagrams.
9. Recommended "turn around" cycles.
10. Inspection procedures.
11. Approved Shop Drawings and Product Data.
12. Equipment Start-up Reports.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.
1.25 ACCEPTANCES

A. The equipment, materials, quality, design and arrangement of all work installed under the Plumbing Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Plumbing Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Plumbing Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Plumbing Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.26 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer’s reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give
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particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Pipe size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.27 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers’ standard warranties on products and special warranties are to be included:

1. General close-out requirements included in Division 01.
2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-02 through -50.
3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that
incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.28 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.
H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
   1. Refer to individual Sections of Divisions-02 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
   2. Identify each binder on the front and the spine with the typed or printed title “WARRANTIES AND BONDS,” the Project title or name, and the name of the Contractor.
   3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.29 GUARANTEES

A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.
1.30 PROJECT CLOSE-OUT

A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 01.

B. Deliver tools, spare parts, extra stock, and similar items.

C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.
   1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.
   2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION
Electronic Drawing File Release Form

DELIVERY OF ELECTRONIC FILES FOR: ________________________________

Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys’ fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____________________________________________ ________________________
Client’s Signature Date

_____________________________________________
Company - Title

_____________________________________________
Architects’ Signature Date

_____________________________________________
Firm - Title

_____________________________________________
Owner’s Signature Date

_____________________________________________
Company - Title
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.
B. Stack sleeves fittings.
C. Sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Division 07 – Thermal and Moisture Protection.
C. Division 09 – Finishes.
D. Section 22 05 23 – General-Duty Valves for Plumbing Piping.
E. Section 22 05 53 – Identification for Plumbing Piping and Equipment
F. Section 22 07 00 – Plumbing Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.

1.04 SUBMITTALS

A. See Division 01 - General Requirements, for submittal procedures.
B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.
   
C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SLEEVES

A. Materials
   1. Cast-Iron Pipe Sleeve: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated
   2. Galvanized Steel Pipe Sleeve: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
   3. Galvanized-Steel Sheet Sleeve: 0.0239-inch thickness; round tube closed with longitudinal joint.

2.02 STACK SLEEVE FITTINGS

A. Manufacturers
   1. Zurn Industries, LLC
   3. MIFAB, Inc.
   4. Josam
   5. Substitutions: See Division - 01 General Requirements.

B. Stack Sleeve Fitting
   1. Galvanized cast iron sleeve with integral flashing flange. Provide underdeck clamp where required.

2.03 SLEEVE-SEAL SYSTEMS

A. Manufacturers:
1. Flexicraft Industries; PipeSeal.
2. Metraflex
3. Link-Seal
4. Substitutions: See Division - 01 General Requirements.

B. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer’s recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 GENERAL

A. Lay out penetration and sleeve openings in advance, to permit provision in work. Coordinate work with architectural and structural work. Set sleeves in forms before concrete is poured. Provide remedial work where sleeves are omitted or improperly placed. Remedial work includes core drilling (see requirements below) for penetrations if walls are poured, or otherwise constructed, without required sleeves. Provide core drilling (see requirements below) of existing construction. Do not penetrate structural members without Structural Engineer’s/Architect's written approval.

B. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

C. Sleeve installation shall meet NFPA-101 requirements, UL rated assemblies requirements, and materials requirements of these specifications. Submit a list of the UL listed details that the Contractor intends on using on this project in all rated assemblies.

D. Sleeves that penetrate outside walls, basement slabs, footings and beams shall be waterproof. Sleeves that penetrate floors shall be waterproof.

E. Where pipes passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.

F. Identify unused sleeves and slots for future installation. Fill slots, sleeves and other openings in floors or walls if not used. Fill spaces in openings after installation of pipe. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes.

G. Do not support piping risers or conduit on sleeves.
H. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for materials.

I. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.

J. Structural Considerations: Do not penetrate building structural members unless indicated.

3.02 APPLICATIONS

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls Above Grade:
      a. Cast-iron pipe sleeves or galvanized-steel pipe sleeves.
   2. Exterior Concrete Walls Below Grade:
      a. Cast-iron pipe sleeves with sleeve-seal system or galvanized-steel-pipe sleeves with sleeve-seal system.
      b. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs-on-Grade:
      a. Cast-iron pipe sleeves with sleeve-seal system, or galvanized-steel-pipe sleeves with sleeve-seal system.
      b. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   4. Concrete Slabs above Grade:
      a. Galvanized-steel-pipe sleeves, or stack sleeve fittings
   5. Interior Partitions:
      a. Cast iron pipe sleeves, galvanized-steel-pipe sleeves, or galvanized-steel-sheet sleeves.
   6. Floors with membrane waterproofing:
      a. Stack sleeve fittings.

3.03 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
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2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 – Thermal and Moisture Protection

E. Sleeves for insulated pipe in non-fire rated construction shall accommodate continuous insulation without compression.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified Division 07 – Thermal and Moisture Protection.

3.04 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

B. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

C. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07 – Thermal and Moisture Protection

D. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

E. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

F. Using grout, seal the space around outside of stack-sleeve fittings.

G. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 – Thermal and Moisture Protection.

3.05 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size.

C. Position piping in center of sleeve.

D. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve.

E. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

F. Install in accordance with manufacturer's recommendations.

3.06 CORE DRILLING

A. Core drilling shall be avoided in new construction. Set sleeves prior to installation of structure for passage of pipes, conduit and ducts. Where core drilling is unavoidable (e.g. when individual sleeves are not installed or incorrectly located) or required by renovation projects, locate required openings prior to coring and submit locations for review.

B. Coordinate openings with other Divisions.

C. Do not disturb existing systems. Protect areas from damage.

D. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.07 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Gate valves.
   2. Ball valves.
   3. Pressure reducing.
   4. Pressure relief.
   5. Strainers.
   7. Reduced pressure backflow preventers.
   8. Thermostatic mixing valves
   10. Gas solenoid valves.
   11. Gas pressure regulators.

B. Related Sections:
   1. Division 01 – General Requirements.
   2. Section 22 04 00 – General Conditions for Plumbing Trades
   3. Section 22 10 05 – Plumbing Piping: Product and installation requirements for piping materials applying to various system types.
   4. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.

1.02 REFERENCES

A. ASTM International:

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 67 - Butterfly Valves.
   2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. Safe Drinking Water Act:
   1. SDWA 1417 - Reduction of Lead in Drinking Water.
1.03 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.
B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of valves
C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.
B. All valve manufacturers shall demonstrate that valve products have been certified per NSF/ANSI Standard 372.
C. All valves installed on the domestic water system shall have labeling of lead content engraved on the valve body.
D. To assure uniformity and compatibility of piping components in grooved end piping systems, all grooved products utilized shall be supplied by Victaulic or an Engineer Approved Equal

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
B. Installer: Company specializing in performing work of this section with minimum 3 years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
C. Provide temporary protective coating on cast iron and steel valves.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Division 01 – General Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.09 WARRANTY

A. Division 01 – General Requirements: Requirements for warranties.

B. Furnish five year manufacturer warranty for valves excluding packing.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish two packing kits for each size valve.

PART 2 PRODUCTS

2.01 GATE VALVES

A. Manufacturers:
   1. Apollo
   2. Milwaukee Valve Co.
   3. NIBCO, Inc.
   4. American Valve Co.
   5. Watts
   6. Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 80, Class 300, bronze body, bronze trim, lead free, threaded bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, solder ends, Milwaukee Valve Company Model # UP115.

C. 2 1/2 inches and Larger: MSS SP 70, Class 175, cast iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends, Milwaukee Valve Company F-2885-FP. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.02 BALL VALVES

A. Manufacturers:
   1. Apollo
2. Milwaukee Valve Co.
3. NIBCO, Inc.
4. American Valve Co.
5. Watts
6. Division 01 – General Requirements

B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two piece bronze body, lead free, type 316 stainless steel ball, full port, teflon seats, stainless steel blow-out proof stem, solder ends with lever handle, Milwaukee Valve Company Model #UPBA450S.

C. 2 inches and Smaller: MSS SP 110, Class 600, bronze, three piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle, Milwaukee Valve Company Model #UPBA350S.

D. 2 inches and Smaller: MSS SP 110, Class 250, bronze, two piece body, lead free, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, press ends, lever handle, Nibco Model # PC585-66-LF.

2.03 WATER PRESSURE REDUCING VALVES

A. Watts Model 223:
   1. Up to 2 Inches: Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, threaded ends, with strainer.
   2. Over 2 Inches (50 mm): Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged, with strainer, MSS-SP-80.

2.04 TEMPERATURE AND PRESSURE RELIEF VALVES

A. Watts Model 40, 140, N240, 340:
   1. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.05 STRAINERS

A. Watts series 77:
   1. Size 2 inch and Under: Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Size 2-1/2 inch to 4 inch: Flanged cast iron body, Class 125 for 200 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.06 FLOW CONTROL VALVES

A. FDI Series ICSS.
   2. Threaded inlet and outlet connection.
   3. Automatic flow cartridge, stainless steel with machined piston, stainless steel spring, factory set calibration.
   4. Maximum operating temperature: 180 degrees F.
   5. NSF 61 certification.

GENERAL-DUTY VALVES FOR PLUMBING PIPING
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B. Victaulic/TA Series 76X:
2. Threaded inlet and outlet connection.
3. Automatic flow cartridge, stainless steel with machined piston, stainless steel spring, factory set calibration.
4. Maximum operating temperature: 180 degrees F.
5. NSF 61 certification.

2.07 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013, AWWA C506; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; test cocks, Watts 909 or equal.

2.08 THERMOSTATIC MIXING VALVES

A. Manufacturers: Symmons model as scheduled on the drawings.

B. Other acceptable manufacturers offer equivalent products:
1. Lawler
2. Leonard
3. Powers
4. Watts

C. Accessories:
1. Check valves on inlets.
2. Volume control shut-off valve on outlet.
3. Stem thermometer on outlet.
4. Strainer stop checks on inlets.

D. Temp control thermostatic controller with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid filled motor with bellows mounted out of water, rough brass finish

E. Valve body: lead free bronze or brass.

F. Cabinet: 16 gage (1.5 mm) prime coated steel, for recessed or surface mounting with keyed lock.

2.09 PLUG VALVES

A. Manufacturers:
1. DeZURIK, Unit of SPX Corp.
2. Flow Control Equipment, Inc.
3. Homestead Valve
4. Milliken Valve Co.
5. Substitutions: Division 01 – General Requirements
B. 2 inches and Smaller: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 300, semi-steel construction, rectangular port, full pipe area, pressure lubricated, teflon packing, flanged ends. Furnish wrench-operated.

2.10 EMERGENCY GAS SOLENOID VALVE

A. Manufacturers:
   1. Asco.
   2. DeZURIK, Unit of SPX Corp.
   3. Tufline.
   4. Substitutions: Division 01 – General Requirements

B. Die-cast aluminum body, Buna “N: seals and discs, 430F stainless steel core and plugnut, 305 stainless steel core tube, 320 stainless steel springs, copper shading coil, zinc plated steel plugs and threaded ends.

C. Operator: Solenoid enclosure, red hat metal type 1 general purpose junction box.

D. Zero differential, internal pilot-operated diaphragm valve incorporating a double disc arrangement.

E. Electrical: Standard coil 120 volts, 60 Hz.

F. Gas valve shall be provided as a normally closed, power open type valve.

2.11 GAS REGULATORS

A. Manufacturers:
   1. Equimeter.
   2. DeZurik.
   4. Substitutions: Division 01 – General Requirements

B. Cast iron body (ASTM A126) spring adjustment, Buna-N soft seat, aluminum orifices, die cast aluminum alloy diaphragm case, vent valve and seal cap.

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01 – General Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.
3.02 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08 - Openings.

F. Refer to Section 22 05 29 for pipe hangers.

G. Refer to Section 22 07 00 for insulation requirements for valves.

H. Refer to Section 22 10 05 for plumbing piping.

3.03 VALVE APPLICATIONS

A. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

B. Install ball valves for throttling, bypass, or manual flow control services.

C. Install lug or grooved end butterfly valves adjacent to equipment when functioning to isolate equipment.

D. Install flow control valves at the remote part of the domestic hot water return system. Valve size shall be minimum of 3/4-inch

E. Provide line sized isolation valves on all domestic water branches greater than ¾” when more than two fixtures are supplied.

F. Install ball valves in domestic water systems for shut-off service.

G. Install ball valves in domestic water systems for throttling service.

H. Install gate valves in sanitary systems for shut-off service.

I. Install gate valves in storm water systems for shut-off service.

END OF SECTION
SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Formed steel channel.
6. Equipment bases and supports.

B. Related Sections:
1. Division 03- Concrete Section 23 04 00 – General Conditions for Mechanical Trades
2. Division 07 - Thermal and Moisture Protection
3. Division 09- Finishes
4. Section 22 04 00 – General Conditions for Plumbing Trades
5. Section 22 10 05 – Plumbing Piping

1.02 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
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E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

F. Underwriters Laboratories Inc.:
   3. UL 1479 - Fire Tests of Penetration Firestops.
   5. UL - Fire Resistance Directory.

1.03 SUBMITTALS

A. Division 01 - General Requirements

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
   1. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Detail fabrication and assembly of trapeze hangers.
   3. Include design calculations for designing trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods and calculations sealed by a registered professional engineer.

E. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.
B. Installer: Company specializing in performing Work of this section with minimum 3 years of experience.

1.06 PRE-INSTALLATION MEETINGS

A. Division 01 - General Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 WARRANTY

A. Division 01 - General Requirements.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Globe Pipe Hanger Products Inc.
   2. Anvil International
   3. Empire Industries
   4. Hilti Inc.
   5. Substitutions: Division 01 - General Requirements

B. Plumbing Piping - DWV:
   1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F708, or MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

D. LP Gas Piping:
1. Conform to MSS SP 58.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded as required by application.

2.03 INSERTS

A. Manufacturers:
1. HiltiInc.
2. Anvil International
3. Eaton
4. 3M
5. Substitutions: Refer to Division 01 – General Requirements.

B. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
2.04 FLASHING

A. Refer to Division 07 - Thermal and Moisture Protection

2.05 SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve
   2. Metraflex; Pipe Wall Sleeve
   3. CCI Pipeline; Pipe Wall Sleeve
   4. GPT – Centuryline Sleeve Series
   5. Substitutions: See Division 01 - General Requirements and 22 04 00 – General Requirements.

B. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D. Pipe Passing Through Below Grade or Exterior Walls:
   1. Anchored Sleeve - Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814-13A in accordance with Division 07 Thermal and Moisture Protection to prevent the spread of fire, smoke, and gases.

F. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

G. Sleeves for Pipes through Non-fire Rated Walls, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

H. Sealant: refer to Division 07 Thermal and Moisture Protection.

2.06 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Fernco
4. BWM
5. Substitutions: Refer to Division 01 – General Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

C. Provide NSF 61 certified assembly when used in potable water storage tank applications.

2.07 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division
4. Unistrut Corp.
5. Substitutions: Refer to Division 01 – General Requirements

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01 - General Requirements.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing and damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.
3.03 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.
B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, or MSS SP 58.
B. Support horizontal piping as scheduled.
C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
D. Place hangers within 12 inches of each horizontal elbow.
E. Use hangers with 1-1/2 inch minimum vertical adjustment.
F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
I. Support riser piping independently of connected horizontal piping.
J. Provide copper plated hangers and supports for copper piping.
K. Design hangers for pipe movement without disengagement of supported pipe.
L. Prime coat exposed steel hangers and supports. [Refer to Section 09 90 00.] Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 Provide supplemental angles.
channels and formed steel supports to support piping, ductwork, equipment, etc. from building’s structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.05 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Division 01

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel.[or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

3.06 INSTALLATION - FLASHING

A. Refer to Division 08 - Openings

B. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

C. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

D. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

E. Seal floors, showers, and mop sink drains watertight to adjacent materials.

F. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.07 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing, and fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel, or stainless steel escutcheons at finished surfaces.

3.08 FIELD QUALITY CONTROL

A. Refer to Division 01 - Quality Requirements and Execution and Closeout Requirements.

3.09 CLEANING

A. Refer to Division 01 - Execution and Closeout Requirements:

3.10 PROTECTION OF FINISHED WORK

A. Refer to Division 01 Execution and Closeout Requirements

3.11 SCHEDULES

<table>
<thead>
<tr>
<th>PIPE HANGER SPACING</th>
<th>MAXIMUM HANGER SPACING</th>
<th>HANGER ROD DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE MATERIAL</td>
<td>Feet</td>
<td>Inches</td>
</tr>
<tr>
<td>Brass</td>
<td>6</td>
<td>1/2</td>
</tr>
<tr>
<td>Cast Iron (All Sizes)</td>
<td>5</td>
<td>5/8</td>
</tr>
<tr>
<td>Cast Iron (All Sizes) with 10 foot length of pipe</td>
<td>10</td>
<td>5/8</td>
</tr>
<tr>
<td>CPVC, 1 inch and smaller</td>
<td>3</td>
<td>1/2</td>
</tr>
<tr>
<td>CPVC, 1-1/4 inches and larger</td>
<td>4</td>
<td>1/2</td>
</tr>
<tr>
<td>Copper Tube and Pipe, 1-1/4 inches and smaller</td>
<td>6</td>
<td>1/2</td>
</tr>
<tr>
<td>Copper Tube and Pipe, 1-1/2 inches and larger</td>
<td>10</td>
<td>1/2</td>
</tr>
<tr>
<td>PEX</td>
<td>2</td>
<td>1/2</td>
</tr>
<tr>
<td>PVC 1 1/2 inch and smaller</td>
<td>3</td>
<td>3/8</td>
</tr>
<tr>
<td>PVC 2 inch and larger</td>
<td>4</td>
<td>3/8</td>
</tr>
<tr>
<td>Steel, 3 inches and smaller</td>
<td>12</td>
<td>1/2</td>
</tr>
<tr>
<td>Steel, 4 inches and larger</td>
<td>12</td>
<td>5/8</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Pipe markers.
D. Underground pipe warning tape
E. Ceiling grid markers

1.02 RELATED REQUIREMENTS

A. Division 09 - Finishes: Identification painting.

1.03 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems
B. American Society for Testing Materials
   1. ASTM D709 - Standard Specification for Laminated Thermosetting Materials
C. National Fire Protection Association
   1. NFPA 99 - Standard for Health Care Facilities

1.04 SUBMITTALS

A. See Division 01 – General Requirements, for submittal procedures.
B. Product Data: Provide manufacturers catalog literature for each product required.
C. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
D. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer’s name and model number.
E. Manufacturer’s Installation Instructions: Indicate special procedures, and installation.
F. Project Record Documents: Record actual locations of tagged valves.
1.05 QUALITY ASSURANCE

A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Identification products shall be provided by the following manufacturers:
   1. Craftmark Pipe Markers
   2. Brimar Industries, Inc.
   4. Seton Identification Products
   5. Substitutions: See Division 01 - General Requirements.

B. All identification products shall be by a single manufacturer

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   2. Letter Height: 1/4 inch.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass Stainless Steel with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.05 UNDERGROUND PIPE WARNING TAPE

A. Detectable Underground Warning Tape: Bright colored continuously printed, 2 mil clear film laminated to ½ mil Aluminum Foil Center Core. Suitable for direct burial. Designed for detectability by non-ferrous locator. Minimum widths as follows:
   1. 2” width for burial depths of up to 12”
   2. 3” width for burial depth of 12” to 18”
   3. 6” width for burial depth of 18” to 24”

B. Provide with a continuous printed message similar to “Caution Water Line Buried Below”.

2.06 CEILING GRID MARKERS

A. Description: 10 mil self-stick vinyl -7/8” diameter markers. Color coded.

B. Color code as follows:
   1. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 – Finishes, for stencil painting.

3.02 INSTALLATION

A. Install identifying devices after completion of testing and installation of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion.

C. Install tags using corrosion resistant chain. Number tags consecutively by location.

D. Install plastic pipe markers in accordance with manufacturer’s instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer’s instructions.

F. Install detectable underground warning tape 6 to 8 inches below finished grade, directly above buried pipe.
3.03  APPLICATIONS

A. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

B. Identify control panels and major control components outside panels with plastic nameplates.

C. Identify valves in main and branch piping with tags.

D. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, and flow direction.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops.
   4. For concealed piping identification shall be located not to exceed 10 feet.
   5. Locate identification adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

E. Identify underground utilities with detectable underground warning tape.

F. Provide ceiling grid markers to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plumbing piping insulation, jackets and accessories.
   2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:
   1. Division 01 General Requirements
   2. Division 07 - Firestopping
   3. Division 09 - Finishes

1.02 REFERENCES (follow the most currently adopted amended version)

A. ASTM International:
   1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless
   2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   8. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
  15. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT


B Underwriters Laboratories Inc.:

1.03 SUBMITTALS

A. Division 01 – General Requirements
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and installation standards will be achieved.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

D. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.08 WARRANTY

A. Division 01 - Execution and Closeout Requirements.

1.09 SCHEDULING

A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2.02 MANUFACTURER

A. Pre-Molded Glass Fiber (PGF):
   1. Johns Manville Corporation – Microlok HP Pipe Insulation
   2. CertainTeed Corporation - Crimpwrap
   3. Knauf Insulation – Earthwool
   4. Owens Corning Corporation; SSL II w ASJ:
   5. Substitutions: Refer to Division 01 – General Requirements.

B. Manufacturers for Closed Cell Elastomeric (CCE) Pipe Insulation Products:
   1. Armacell LLC - AP Armaflex 25/50
   2. Aeroflex USA, Inc – Aerocel –SSPT w/SaniGuard
   3. K-Flex USA LLC – Insul-tube
   4. Substitutions: See Division 01 – General Requirements.

C. Manufacturers for PVC Jacketing (PVC):
   1. Johns Manville - Zeston
   2. P.I.C. Plastics Inc.
   3. Proto Corporation
   4. Substitutions: Division 01.

D. Manufacturers for Aluminum Jacketing (ALM):
   1. Johns Manville
   2. ITW Insulation Systems
   3. RPR Products – Insul-Mate
   4. Substitutions: Division 01.

2.03 PIPE INSULATION

A. Pre-Molded Glass Fiber (PGF) Pipe Insulation:
   1. ASTM C547 and ASTM C795, rigid molded, noncombustible with jacket.
   2. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   3. Maximum Service Temperature: 850 degrees F.
   4. Maximum Moisture Absorption: 0.2 percent by volume.
   5. Vapor Barrier Jacket: Outer film layer, kraft paper with glass fiber yarn,
      bonded to aluminized film; moisture vapor transmission when tested in
      accordance with ASTM E96 of 0.02 perm-inches.
   6. Vapor Barrier Lap Adhesive: Compatible with insulation.

B. Closed Cell Elastomeric (CCE) Pipe Insulation:
   1. Preformed flexible elastomeric cellular rubber insulation complying with
      ASTM C534 Grade 3; use molded tubular material wherever possible.
   2. 'K' Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature
      of 75 degrees F
   3. Minimum Service Temperature: Minus 40 degrees F
   4. Maximum Service Temperature: 220 degrees F

2.04 JACKETS

A. Polyvinyl-chloride Plastic Pipe Jacket (PVC):
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic: Compatible with insulation.

   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.05 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.


F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.06 EQUIPMENT INSULATION

A. Pre-Molded Glass Fiber (PGF) Equipment Insulation:
   1. ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
   2. Thermal Conductivity: 0.24 at 75 degrees F
   3. Operating Temperature Range: 0 to 450 degrees F
4. Density: 3 pound per cubic foot

B. Closed Cell Elastomeric (CCE) Equipment Insulation:
   1. ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
   2. ‘K’ Value: ASTM C177, between 0.21 and 0.27 at mean rating temperature of 75 degrees F
   3. Operating Temperature Range: Range: Minus 70 to 220 degrees F

2.07 EQUIPMENT INSULATION ACCESSORIES

   A. Vapor Retarder Lap Adhesive: Compatible with insulation.
   B. Covering Adhesive Mastic: Compatible with insulation.
   C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
   D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
   E. Adhesives: Compatible with insulation. Refer to manufacturers’ installation manual.

PART 3 EXECUTION

3.01 EXAMINATION

   A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.
   B. Verify that piping and equipment has been tested before applying insulation materials.
   C. Verify that piping and equipment surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION - PIPING

   A. Install in accordance with manufacturer's instructions.
   B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
   C. Piping and fittings exposed to view: Provide with PVC Plastic pipe jacketing and fittings for additional protection. Locate insulation and cover seams in least visible locations.
   D. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports,
protrusions, and interruptions. Refer to Section 07 for penetrations of assemblies with fire resistance rating greater than one hour.

E. Insulated pipes conveying fluids below ambient temperature:
1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

F. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

G. Pre-molded Glass Fiber (PFG) insulated pipes conveying fluids above or below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with PVC fitting covers.

H. For hot piping conveying fluids, insulate flanges and unions at equipment.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 – Thermal and Moisture Protection for penetrations of assemblies with fire resistance rating greater than one hour.

J. Buried Piping: Provide closed cell elastomeric insulation with all-purpose service jacket with self-sealing lap.

K. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer and according to the heat trace manufacturer’s installation instructions. Verify required thickness with heat trace manufacturer’s installation instructions. Cover with aluminum jacket with seams located on bottom of horizontal piping.

L. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

M. Closed Cell Elastomeric (CCE) Insulation:
1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer’s recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

N. Prepare pipe insulation for finish painting. Refer to Division 09.

3.03 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing all Fluids Above Ambient Temperature:
1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
3.04 PIPE INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 22 option.

B. Insulation for pre-insulated piping shall meet all specified requirements.

C. Insulation thickness shall be coordinated with heat trace manufacturers’ installation instructions. Listed sizes on schedule shall be used as minimum sizes only.
## Domestic Hot Water Supply and Recirculation Systems

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>Pipe Size (inch)</th>
<th>Indoor - Minimum Thickness (inch)</th>
<th>Factory Applied Jacket</th>
<th>Field Applied Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Molded Glass Fiber (PFG)</strong></td>
<td>1-1/4 inches and smaller</td>
<td>1.0</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms.</td>
</tr>
<tr>
<td></td>
<td>1-1/2 inches and larger</td>
<td>1.5</td>
<td>ASJ-SSL</td>
<td></td>
</tr>
<tr>
<td><strong>Closed Cell Elastomeric (CCE)</strong></td>
<td>1-1/4 inches and smaller</td>
<td>1.0</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms.</td>
</tr>
<tr>
<td></td>
<td>1-1/2 inches and larger</td>
<td>1.5</td>
<td>ASJ-SSL</td>
<td></td>
</tr>
</tbody>
</table>

## Domestic Cold Water Supply Systems

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>Pipe Size (inch)</th>
<th>Indoor - Minimum Thickness (inch)</th>
<th>Factory Applied Jacket</th>
<th>Field Applied Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Molded Glass Fiber (PFG)</strong></td>
<td>1-1/4 inches and smaller</td>
<td>0.5</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms.</td>
</tr>
<tr>
<td></td>
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<td>1.0</td>
<td>ASJ-SSL</td>
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</tr>
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<td></td>
<td>1-1/2 inches and larger</td>
<td>1.0</td>
<td>ASJ-SSL</td>
<td></td>
</tr>
</tbody>
</table>
## Storm Systems: Horizontal Above Ground Within Building For The First 30 Feet

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>Pipe Size (inch)</th>
<th>Indoor - Minimum Thickness (inch)</th>
<th>Factory Applied Jacket</th>
<th>Field Applied Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Molded Glass Fiber (PFG)</td>
<td>All Sizes</td>
<td>0.5</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms.</td>
</tr>
<tr>
<td>Closed Cell Elastomeric (CCE)</td>
<td>All Sizes</td>
<td>0.5</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms.</td>
</tr>
</tbody>
</table>

## Sanitary and Storm PVC Systems: Vertical Above Ground Within Building

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>Pipe Size (inch)</th>
<th>Indoor - Minimum Thickness (inch)</th>
<th>Factory Applied Jacket</th>
<th>Field Applied Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Molded Glass Fiber (PFG)</td>
<td>All Sizes</td>
<td>0.5</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM</td>
</tr>
<tr>
<td>Closed Cell Elastomeric (CCE)</td>
<td>All Sizes</td>
<td>0.5</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. LP Gas.
   4. Flanges, unions, and couplings.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Division 08 – Openings.

C. Division 07 - Thermal and Moisture Protection

D. Division 09 - Finishes.

E. Section 22 04 00 – General Conditions for Plumbing Trades.

F. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

G. Section 22 07 00 - Plumbing Insulation.

H. Division 26 – Electrical: Electrical characteristics and wiring connections.

I. Division 31 - Earthwork

J. Division 33 - Utilities.

1.03 REFERENCE STANDARDS – Most Currently adopted versions and amendments for the location of the project.

A. American National Standards Institute

B. American Society of Mechanical Engineers
   2. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.
   3. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250.
4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
9. ASME B31.9 - Building Services Piping.
11. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.

C. American Society of Sanitary Engineering
   1. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

D. American Society for Testing and Materials
27. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
40. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
44. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.

E. American Welding Society
1. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
2. AWS D1.1 - Structural Welding Code - Steel.

F. American Water Works Association
1. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
5. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
6. AWWA C606 - Grooved and Shouldered Joints.
7. AWWA C651 - Disinfecting Water Mains.
9. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

G. Cast Iron Soil Pipe Institute

H. International Code Council
1. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Element.
2. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
I. Manufacturers Standardization Society
2. MSS SP-67 - Butterfly Valves.
3. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 20DA.
  MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
7. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

J. National Sanitation Foundation
1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

K. National Fire Protection Association
1. NFPA 54 – Natural Gas Code

L. Plastic Pipe Institute
1. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe.

1.04 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welder’s certification of compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 - General Requirements.
   2. Valve Repacking Kits: One for each type and size of valve.
1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.
D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM 1784 or ASTM D3034 (SDR 35).
   1. Fittings: PVC.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.

C. PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 with not less than 150 psi pressure rating.
   1. Fittings: ASTM D2466, PVC.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

B. Copper Pipe: ASTM B42, annealed.

2.05 DOMESTIC WATER PIPING, BURIED, PRE-INSULATED

A. Description: Factory fabricated piping with carrier pipe, insulations and casing.

B. Carrier Pipe: Type L Hard Drawn Copper Tubing conforming to ASTM B-88 in 20-foot lengths

C. Carrier Pipe Insulation:
   1. hi-temp Polyurethane Foam insulation
   2. K-Factor of .165 density of 2 PCF  
   3. closed cell content of 90%,
   4. compressive strength of 35 PSI
   5. carrier temperature of 300ºF
6. Conform to ASTM standard D1621, 1622, 1623, 2126, 2842, 2856, and C518-91 completely filling the annular space between the carrier pipe and jacketing.

D. Casing: High-density PVC.

E. Joining Method:
   1. Straight lengths of pipe will be joined by solder connection.

F. Fittings and Field Joints:
   1. All fittings will be wrought copper in conformance with job specifications and will be insulated and jacketed with materials supplied by the system supplier and as per manufacturers standard procedures.

G. End Seals:
   1. Each length of pre-insulated pipe will be fitted with a watertight mastic end seal at jacket and pipe surfaces. All field cuts will be sealed with a field applied end seal.

H. Anchors:
   1. All pipe shall be anchored per system supplier's recommendations.

I. Backfill:
   1. Should be tampered compactly in place so as to assure a stable surface. No rock should be used in the first foot of backfill. 24 inches, top of pipe to grade, of compacted fill shall meet H-20 Highway loading.

2.06 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88, Type K (A).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   4. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non-toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Mueller Streamline Co (Mass approved manufacturer)
         2) Oatey Company (Mass approved manufacturer)
         3) Cambridge Lee Industries (Mass approved manufacturer)
         4) JM Eagle (Mass approved manufacturer)
         5) Viega LLC
         6) Substitutions: Division 01- General Requirements.

B. Steel Pipe: ASTM A53 Schedule 40, galvanized, using one of the following joint types:
   1. Threaded Joints: ASME B16.4 cast iron fittings.
2. Grooved Joints: AWWA C606 grooved pipe, cast iron fittings, and mechanical couplings.

C. CPVC Pipe: ASTM D2846, ASTM F441, or ASTM F442.

D. PVC Pipe: ASTM D1785 or ASTM D2241.
1. fittings: ASTM D2665, PVC.

E. Polyethylene/Aluminum Composite Pipe: ASTM F1281 or ASTM F1282, tested for potable water and residual chlorine use.
1. Fittings and Joints: Brass compression type.

F. Stainless Steel Pipe: ASTM A269, Grade TP304 alloy.
1. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
   a. Manufacturers:
      1) Grinnell Products, a Tyco Business
      2) Bristol Metals (Mass approved manufacturer)
      3) Viega LLC (Mass approved Manufacturer).
      4) Victaulic Company (Mass approved manufacturer)
      5) Substitutions: Division 01 - General Requirements.

2.07 LP GAS PIPING, BURIED BEYOND 10 FEET OF BUILDING

A. Steel Pipe: ASTM A53 Schedule 40 black.
1. Fittings: ASTM A234, wrought steel welding type, with AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

B. Polyethylene Pipe: ASTM D2513, SDR 11.
1. Fittings: ASTM D2683 or ASTM D2513 socket type.

2.08 LPG GAS PIPING, BURIED WITHIN 10 FEET OF BUILDING

A. Steel Pipe: ASTM A53 Schedule 40 black.
1. Fittings: ASTM A234, wrought steel welding type.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.09 LPG GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53 Schedule 40 black.

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1. Fittings: ASME B16.3, malleable iron, or ASTM A234, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A).

2.10 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47 malleable iron, ductile iron, or galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   7. Manufacturers:
      a. Grinnell Products, a Tyco Business
      b. Bristol Metals (Mass approved manufacturer)
      c. Viega LLC (Mass approved Manufacturer).
      d. Victaulic Company (Mass approved manufacturer)
      e. Substitutions: Division 01 - General Requirements.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier are required where two dissimilar metal products are connected within a system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.
3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer’s instructions.
B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
F. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Division 08 Openings.
G. Establish elevations of buried piping outside the building to ensure not less than the local area’s frost depth of cover.
H. Install vent piping penetrating roofed areas to maintain integrity of roof assembly and a minimum of 25 feet from an air intake; refer to Division 08 Openings.
I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
J. Provide support for utility meters in accordance with requirements of utility companies.
K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior plumbing systems and components are specified in Division 09 - Finishes.
   2. Painting of exterior plumbing systems and components are specified in Division 09 - Finishes.
L. Excavate in accordance with Division 31- Earthwork requirements.
M. Backfill in accordance with Division 31 – Earthwork requirements
N. Install bell and spigot pipe with bell end upstream.
O. Install water piping to ASME B31.9.

P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

Q. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

R. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 TOLERANCES

A. Sanitary Drainage Piping: slope to sanitary drain at minimum of 1/8 inch per foot.

B. Pressure test LPG piping in accordance with NFPA 58.

3.05 SYSTEM FLUSHING

A. The following system flushing criteria shall apply to all domestic water piping systems inclusive of hot water, cold water and hot water recirculation.

B. Upon completion of installation of piping, and prior to disinfection, flush the piping systems with clean, potable water until dirty water does not appear at the points of outlet.

C. Remove strainers and flow restrictors from fixtures prior to flushing and reinstall after flushing is complete.

D. Mixing valves located at fixtures shall not be installed until after flushing is complete. Provide temporary bypass connections as required.

E. Provide isolation and temporary bypass piping for water heaters, expansion tanks, and other equipment.

F. Run fixtures simultaneously for a minimum of 30 minutes or until no debris is evident.

G. Flushing shall be considered satisfactory when no debris is evident after running water through a number 80 mesh screen.

H. Contractor to notify engineer and owner a minimum of 72 hours before performing flushing.

I. Once system has been successfully flushed, contractor shall provide a report to engineer documenting flushing procedure and results.
3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION
PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Attention is directed to the following specifications sections, which are hereby made a part of this Section of the Specifications.

1. Division 01 - General Requirements
2. Division 07 – Thermal and Moisture Protection: Product requirements for calking between fixtures and building components for placement by this section.
3. Division 11 – Equipment.
4. Division 12 – Furnishings: “Plastic Laminate-Clad Countertops”
5. Division 12 – Furnishings: “Solid Surface Countertops”
6. Section 22 05 53 – Identification for Plumbing Piping and Equipment.
7. Section 22 05 79 – Hangers and Supports for Plumbing Piping and Equipment.
8. Section 22 04 00 – General Conditions for Plumbing Trades
9. Section 22 07 00 – Plumbing Insulation.
10. Section 22 10 05 Plumbing piping: Supply connections to plumbing fixtures.
11. Section 22 05 23 – General Duty Valves for Plumbing Piping.
12. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

1.02 SUMMARY

A. Section includes the following plumbing fixtures:

1. Electric water coolers
2. Janitors sinks.
3. Lavatories.
4. Sinks.
5. Water closets.

B. Section includes the following plumbing specialties:

1. Reduced Pressure Backflow Preventers.
2. Cleanouts.
3. Fixture supports.
4. Floor drains.
5. Floor sinks.
6. Hose bibs.
7. Lavatory insulation kit.
8. Plumbing traps.
9. Recessed valve boxes.
10. Grease interceptors
11. Trap primers.
12. Wall hydrants.
14. Stops
1.03 REFERENCES

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. American National Standards Institute:

1. ANSI 61 - Drinking Water System Components
2. ANSI A112.21.1 - Floor Drains.
3. ANSI A112.21.2 - Roof Drains.
6. ANSI Z124.1 - Plastic Bathtub Units.
7. ANSI Z124.2 - Plastic Shower Units.

C. Air-Conditioning and Refrigeration Institute:

1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

D. American Society of Mechanical Engineers:

1. ASME A112.6.3 – Floor and Trench Drains
2. ASME A112.6.4 – Roof, Deck, and Balcony Drains
3. ASME A112.18.1 - Plumbing Supply Fittings.
4. ASME A112.18.1M – Plumbing Fixture Fittings.
5. ASME A112.18.2 – Plumbing Waste Fittings.
7. ASME A112.19.2 - Ceramic Plumbing Fixtures.
8. ASME A112.19.3 - Stainless Steel Plumbing Fixtures
9. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.
10. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
13. ASME A112.19.19 Vitreous China Non-water Urinals
14. ASME A112.6.1 - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
15. ASME A112.36.2M – Cleanouts.

E. American Society of Testing and Materials

3. ASTM C1613-17 - Standard Specification for Precast Concrete Grease Interceptor Tanks

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5. ASTM F2649-14 - Standard Specification for Corrugated High Density Polyethylene (HDPE) Grease Interceptor Tanks
6. ASTM D-4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

F. American Society of Safety Engineers:

1. ASSE 1012, Performance Requirements For Backflow Preventers With An Intermediate Atmospheric Vent
2. ASSE 1013, Performance Requirements for Reduced Pressure Principle Backflow Preventers
3. ASSE 1016/ASME A112.1016/CSA B125.16-11, Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations
4. ASSE 1017, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems
5. ASSE 1062, Performance Requirements for Temperature Actuated Flow Reduction (TAFR) Valves for Individual Fixture Fittings
6. ASSE 1066, Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings
7. ASSE 1069, Performance Requirements for Automatic Temperature Control Mixing Valves
8. ASSE 1070/ASME A112.1070/CSA B125.70-15, Performance Requirements for Water Temperature Limiting Devices
9. ASSE 1071, Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

G. American Society of Heating, Refrigeration and Air Conditioning Engineers:


H. International Association of Plumbing and Mechanical Officials:

1. IAPMO IGC 187 – Roof Drains with Integral Overflow Drain.
2. IAPMO Z124 - Plastic Plumbing Fixtures.
3. IAPMO Z403-13 - Terrazzo, Concrete, and Natural Stone Plumbing Fixtures

I. International Surface Fabricators Association:

1. ISFA 2-01 – Classification and Standards for Solid Surfacing Material

J. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

K. Plumbing Drainage institute:

1. PDI WH-201 – Water Hammer Arresters.

1.04 SUBMITTALS

A. Division 01 - General Requirements.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
D. Samples: Submit two lavatory supply fittings fixtures for color matching.

E. Manufacturer’s Installation Instructions: Submit installation methods and procedures. Indicate assembly and support requirements.

F. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

G. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

H. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

I. Waterless Urinals: Submit recommended frequency of maintenance and parts replacement, methods of cleaning, sources of replacement supplies and parts.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner’s name and registered with manufacturer.

1.05 CLOSEOUT SUBMITTALS

A. Division 01 - General Requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State of Connecticut standard.

B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

D. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.08 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.09 MOCKUP

A. Division 01 - General Requirements.

B. Construct mockup of typical bathroom group.
C. Locate where directed by Architect/Engineer.
D. Incorporate accepted mockup as part of Work.

1.10 PRE-INSTALLATION MEETINGS
A. Division 01 - General Requirements.
B. Convene minimum one week prior to commencing work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING
A. Division 01 - General Requirements.
B. Accept products on site in factory packaging. Inspect for damage.
C. Protect installed fixtures and specialties from damage by securing areas and by leaving factory packaging in place to protect fixtures and specialties, and prevent use.

1.12 WARRANTY
A. Division 01 - General Requirements.
B. Furnish five year manufacturer warranty for plumbing fixtures.

1.13 EXTRA MATERIALS
A. Division 01 - General Requirements.
B. Furnish two sets of faucet washers flush valve service kits lavatory supply fittings shower heads toilet seats.
C. Provide two loose keys for hose bibs and wall hydrants.
D. Furnish supply of chemicals for treatment and testing during warranty period of solar hot water system.

PART 2 PRODUCTS

2.01 GENERAL
A. See schedule on drawings for additional requirements and accessories.
B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 ELECTRIC WATER COOLERS
A. Electric Water Cooler Manufacturers:
   1. Elkay.
   2. Haws.

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3. Oasis.
5. Substitutions: Division 01 - General Requirements.

B. Water Cooler: ARI 1010

C. All components of the electric water cooler in the wetted surface material shall be lead free in accordance with SDWA 1417

1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
2. Electrical: 115 V, 60-Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector. Refer to division 26 plans and specifications.

2.03 JANITOR SINKS

A. Manufacturers:

1. American Standard
2. Acorn
3. Fiat
4. Kohler Co.
5. Just
6. Substitutions: Division 01 - General Requirements.

B. IAPMO Z403-13; Molded stone basin and integral drain body.

C. IAPMO Z124; Plastic basin and integral drain body.

D. Supply Faucets

1. Manufacturers
   a. Speakman
   b. American Standard, Inc.
   c. Kohler Company
   d. Zurn Industries, Inc.
   e. Symmons
   f. T&S Brass
   g. Chicago Faucets
   h. Substitutions: Division 01 - General Requirements.

E. Faucet and Trim: ASME A112.18.1, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

F. Provide a combination service sink faucet and eyewash/drench hose unit, complete with thermostatic mixing valve.

1.2 EMERGENCY EYE AND FACE WASH

A. Emergency Wash Manufacturers:

1. Bradley Corp.
2. Guardian.
3. Speakman
4. Substitutions: Division 01 - General Requirements.

B. ANSI Z358.1; wall-mounted, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

C. Provide thermostatic pressure balancing anti-scald mixing valve on inlet pipe with temperature gauge.

2.04 LAVATORIES (PRIVATE)

A. Manufacturers:

1. American Standard
2. Willoughby
3. Bradley
4. Kohler Co.
5. Crane
6. Acorn
7. Substitutions: Division 01 - General Requirements.

B. Basin: ASME A112.19.2; Vitreous China Counter Top Lavatory: Self-rimming counter top lavatory, front overflow, seal of putty, caulking, or concealed vinyl gasket.

C. Basin: ASME A112.19.2; Vitreous China Wall Hung Basin: 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

D. Supply Fitting: ASME A112.18.1: chrome plated combination supply fitting with pop-up waste, chrome plated brass P-trap with clean-out plug and arm with escutcheon.

E. Lavatory faucet controls shall be located within 13 inches from leading edge of lavatories in accordance with federal register rules and regulations.

F. Supply Faucets

1. Manufacturers
   a. Symmons
   b. American Standard, Inc.
   c. Kohler Company
   d. Zurn Industries, Inc.
   e. T&S Brass
   f. Chicago Faucets
   g. Substitutions: Division 01 - General Requirements.

2. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator

G. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.

H. Waste Fittings: ASME A112.18.2 or ASTM F 409.

I. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Trap and waste insulated and offset to meet ADA compliance.

J. Wall Mounted Carrier: ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. See drawings for additional requirements and accessories.

2.05 SINKS

A. Manufacturers:
2. Elkay.
4. Kohler Co.
5. Crane.
6. Substitutions: Division 01 - General Requirements.

B. Single Compartment Bowl: ASME A112.19.3; 18 gage thick, Type 302 stainless steel. Self-rimming and undercoated, with stainless steel drain 3-1/2 inch crumb cup and tailpiece, ledge back drilled for trim. See drawings for additional requirements and accessories.

C. Double Compartment Bowl: ASME A112.19.3; 18 gage thick, Type 302 stainless steel. Self-rimming and undercoated, with stainless steel drains 3-1/2 inch crumb cups and tailpieces, ledge back drilled for trim. See drawings for additional requirements and accessories.

D. Enameled Bowl: ASME A112.19.4M; steel, porcelain enameled, single compartment, outside dimensions, self-rimming and undercoated, with 3-1/2 inch diameter crumb cup and chromed brass tailpiece, ledge back drilled for trim.

E. Supply Faucets

1. Manufacturers
   a. Elkay
   c. Kohler Co.
   d. T&S Brass.
   e. Chicago Faucets.
   f. Substitutions: Division 01 - General Requirements.

2. Supply Fitting: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum

F. For public hand washing facilities, provide tempered water through regulating device conforming to ASSE 1070.

G. Accessories: Chrome plated 17-gauge brass P-trap with clean-out plug and arm with escutcheon, screwdriver stop, and rigid supplies. Trap and waste insulated and offset to meet ADA compliance.

H. Sink faucet controls shall be located within 13 inches from leading edge of sink in accordance with federal register rules and regulations.
2.06 WATER CLOSETS – FLUSH VALVE

A. Manufacturers:

1. American Standard
2. Gerber Plumbing Fixtures LLC
3. Zurn
4. Toto
5. Kohler Co.
6. Crane
7. Substitutions: Division 01 - General Requirements

B. Bowl: ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

C. Flush Valve Manufacturers:

1. Sloan
2. American Standard
3. Zurn
4. Hydrotek
5. Substitutions: Division 01 - General Requirements.

D. Exposed Flush Valve: ASME A112.18.1; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker, maximum 1.6 gallon flush volume.

E. Seat: Solid white plastic, open front, extended back, brass bolts, without cover. See drawings for additional requirements and accessories.

F. Wall Mounted Carrier: ASME A112.6.1; cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

1.3 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:

1. Watts.
2. Zurn
3. Apollo Valves

B. Substitutions: See Division 01 - General Requirements.

C. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.07 CLEANOUTS

A. Manufacturers:

1. J.R. Smith.
2. Josam.
3. Zurn.
5. Wade.
6. Substitutions: Division 01 - General Requirements.

B. ASME A112.36.2M; Cleanouts: Cast iron body with adjustable scoriated nickel bronze top and vandal proof screws.

C. Interior Finished Wall Cleanouts: Line type with cast iron body, round epoxy coated gasketed cover and round stainless steel access cover secured with machine screw.

D. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide stack cleanouts on vertical rainwater leaders.

E. Cleanout plugs shall be screwed brass installed either in cast iron-caulked ferrules or directly into threaded drainage fittings. Above floor cleanouts on stacks may be "Dandy" cleanouts.

F. Refer to other Sections of the Specification for access doors which may be used in lieu of covers specified below.

G. Cleanouts are to be accessible and locations coordinated with cabinetry, shelving and other architectural details. DO NOT place cleanouts where they will not be readily accessible.

2.08 FIXTURE SUPPORTS

A. Manufacturers:

1. J.R. Smith.
2. Josam.
3. Wade.
4. Zurn.
5. MIFAB.
6. Substitutions: Division 01 - General Requirements.

B. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

C. For each wall-hung lavatory, urinal, water cooler, drinking fountain and water closet, provide concealed carrier suited for fixture, location, wall thickness and material.

D. Concealed carriers with exposed arms for sinks and lavatories shall have acid-resisting enamel finish.

2.09 FLOOR DRAINS

A. Manufacturers:

1. J.R. Smith
2. Josam
3. Watts.
4. Wade.
5. Zurn
6. Substitutions: Division 01 - General Requirements.
B. ANSI A112.21.1. Round adjustable nickel-brass strainer, cast iron body, cast iron drainage flange, flashing clamp, and sediment bucket, provide with trap primer.

C. ANSI A112.21.1. Square, cast iron, drainage flange with weep holes, and internal cast iron dome strainer: Provide trap primer.

D. Drains shall have traps.

2.10 FLOOR SINK

A. Manufacturers:
   1. J.R. Smith.
   2. Josam.
   3. Watts.
   4. Zurn.
   5. Wade
   6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.21.1. Square, cast iron, drainage flange with weep holes, and internal cast iron dome strainer: Provide trap primer.

C. Provide full, half, quarter grates, or less grate as required to suit job conditions.

2.11 HOSE BIBS

A. Manufacturers:
   1. Woodford.
   2. Josam.
   3. Wade.
   4. Zurn.
   5. Watts.
   6. Substitutions: Division 01 - General Requirements.

B. ANSI/ASSE 1011; Bronze or brass with integral mounting flange.

2.12 SOLID INTERCEPTOR

A. Manufacturers:
   1. Jay R Smith
   2. Zurn
   3. Watts
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.13 LAVATORY INSULATION KIT

A. Manufacturers:
   1. McGuire
   2. Truebro
   3. Plumerex
   4. Substitutions: Division 01 - General Requirements.
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

B. ANSI A177.1; Where Lavatories are noted to be insulated for ADA compliance, furnish safety covers consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.14 PLUMBING TRAPS

A. Manufacturers:

1. McGuire Manufacturing Co.
2. Josam.
3. Wade.
4. Zurn.
5. Substitutions: Division 01 - General Requirements.

B. ASTM A888-20; Fixture traps shall be 17 gauge or heavier material; other traps shall be of same size and material as pipe on which trap occurs.

C. Provide cleanout for each trap. Running traps shall have double hubs for two cleanouts.

D. Provide deep traps with 4” minimum seal, for floor drains.

2.15 RECESSED VALVE BOXES

A. Manufacturers:

1. Watts.
2. Woodford.
4. Wade.
5. Zurn.
6. Substitutions: Division 01 - General Requirements.

B. ASME A112.18.1;

C. Refrigerator: Plastic preformed rough-in box with brass water control valve.

D. Washing Machine: Plastic preformed rough-in box with brass water control valve, socket for 2 inch waste, and cover.

2.16 GREASE INTERCEPTOR

A. Manufacturers:

1. Zurn.
2. Watts.
3. Thermaco.
4. Old Castle.
5. J.R. Smith
6. Substitutions: Division 01 - General Requirements.

B. ASTM C1613-17; Precast concrete tanks.

C. ASTM F2649-14; HDPE tanks.
2.17 TRAP PRIMERS

A. Manufacturers:
   1. Woodford.
   2. Josam.
   3. Wade.
   4. Zurn.
   5. Watts.
   6. PPP.
   7. Substitutions: Division 01 - General Requirements.

B. ASSE 1018; Corrosion resistant brass, temperature range –40 to 450 degrees, ½” male inlet and ½” female outlet, pressure operating range 35 to 75 psig.

2.18 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Woodford.
   2. Josam.
   3. Wade.
   4. Zurn.
   5. Watts.
   6. Substitutions: Division 01 - General Requirements.

B. ANSI A112.26.1; sized in accordance with PDI, precharged, suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250

2.19 STOPS

A. Manufacturers:
   1. Brass Craft.
   2. Watts.
   5. Substitutions: Division 01 - General Requirements.

B. ASME A112.18.1;

C. Chrome plated angle brass supply stop valve with full turn brass stem, lead free, inlet shall be 1/2-inch sweat, outlet shall be 3/8-inch compression.

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01 - General Requirements

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.
3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

B. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.03 INSTALLATION

A. Install Work in accordance with State of Connecticut standards.

B. Install in accordance with manufacturer’s instructions.

C. Install each fixture with trap, easily removable for servicing and cleaning.

D. Provide chrome plated rigid supplies to fixtures with screwdriver stops, reducers, and escutcheons.

E. Install components level and plumb.

F. Install and secure fixtures in place with wall carriers and bolts.

G. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, color to match fixture.

H. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

I. For ADA accessible water closets, install flush valve with handle to wide side of stall.

J. Refer to architectural drawing for required mounting heights of fixtures.

K. Install in accordance with manufacturer’s instructions.

L. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

M. Cleanouts shall be same size as the pipes served, up to 4 inches; 5 and 6 inch pipes shall have 4 inch cleanouts; 8 inch pipes shall have 6 inch cleanouts; 10 inch pipes and larger shall have 8 inch cleanouts.

N. Install components level and plumb.

O. Install water hammer arrestors with isolation valve in accessible locations.

P. Trap primers shall be installed to serve all floor drains, provide distribution units as required for all drains.

Q. Provide 1/2 grate cover on all floor sinks as required for discharge pipe into floor sink, cut inlet pipe on 45 degree angle.
R. Trap primer connections shall be installed on cold water piping 1 ½ inch diameter or less.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Division 01 - General Requirements: Product Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.07 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - General Requirements: Product Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

3.08 COMMISSIONING OF EQUIPMENT

A. Engage a factory-authorized service representative, who is familiar with this project, to participate and assist, if necessary, in the functional performance testing of this equipment with the Commissioning Agent.

END OF SECTION
PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to all Divisions 23 Sections.

B. This section applies to certain sections of Division 26, "Electrical," and this section applies to all sections of Division 23, "Mechanical" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades (Architectural, Food Service, Structural, Landscape, Civil, Mechanical, Fire Protection and Plumbing) shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

1.02 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division. Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

1.03 INTENT

A. It is the intent of the Specifications and Drawings to call for finished work, tested and ready for operation. Provide all parts necessary for the intended use, fully complete and operational, and installed in professional manner in accordance with the design intent.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.
C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section includes the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

1.04 DEFINITIONS

A. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

B. “Approved equal” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. “Finished” refers to all rooms and areas to be specified to receive architectural treatment as indicated on the drawings. All rooms and areas not covered, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

E. “Furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, ready to be installed including where appropriate all necessary interim storage and protection.

F. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

G. “Install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

H. “Product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

I. “Provide” shall mean furnish (or supply) and install as necessary.
J. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

K. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

L. Special Warranties: The term “Special Warranties” are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

M. Standard Product Warranties: The term “Standard Product Warranties” are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

N. “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

O. Substitutions: Requests for changes in products, materials, equipment, and methods of construction proposed by the Contractor are considered requests for "substitutions."

P. “Wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

1.05 CONTRACT DOCUMENTS

A. The two dimensional drawings govern the construction. They show the design intent and are part of the Contract Documents. BIM models are not part of contract documents. They are developed for convenience only.

B. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

C. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

D. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.
1.06 DISCREPANCIES IN DOCUMENTS

A. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

B. Where Drawings or Specifications conflict or are unclear, submit clarification request in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or un-clarities thus resolved.

C. Where Drawings or Specifications do not coincide with manufacturers' recommendations or with applicable codes and standards, submit clarification request in form of an RFI before installation. Otherwise, make changes in installed work required for compliance with manufacturer instructions or codes and standards within Contract Price.

D. Where insufficient information exists in the documents to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements, where notification required by Paragraph (B) above has not been submitted, provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in professional manner either concealed or exposed in accordance with the design intent.

E. Where discrepancies exist between the mechanical, plumbing, fire protection, and electrical drawings in regards to what trade owns disconnects or starters, the discrepancy shall be brought to the Architect's attention in accordance with paragraph (B) above. If the scope is not resolved prior to the Award of Contract, Division 26 shall provide such items.

1.07 SURVEYS AND MEASUREMENTS

***** NOTE: DELETE SUBPARAGRAPH BELOW FOR NEW CONSTRUCTION PROJECTS. *****

A. Before submitting their Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before the job is considered complete. The Contractors shall be held responsible for any assumptions he makes, any omissions or errors he makes as a result of his failure to become fully familiar with the existing conditions at the site and the Contract Documents.
B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.08 CODES AND STANDARDS

A. Reference Standard Compliance
   1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
   
   2. Independent Testing Organization Certificate: In lieu of the label or listing indicated above, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision of the local building or life safety code shall be followed.

C. The following Standards shall be used where referenced by the following abbreviations:

   AABC  Associated Air Balance Council
   ACGIH  American Conference of Governmental Industrial Hygienists
   ADC    Air Diffusion Council
   AGA    American Gas Association
   AIA    American Institute of Architects
   AMCA   Air Moving and Conditioning Association
   ANSI   American National Standards Institute
   API    American Petroleum Institute
   ARI    Air Conditioning and Refrigeration Institute
ASHRAE  American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME  American Society of Mechanical Engineers
ASPE  American Society of Plumbing Engineers
ASSE  American Society of Sanitary Engineers
ASTM  American Society of Testing and Materials
AWS  American Welding Society
AWWA  American Water Works Association
CGA  Compressed Gas Association
CSA  Canadian Standards Association
CISPI  Cast Iron Soil Pipe Institute
EJMA  Expansion Joint Manufacturing Association
EPA  Environmental Protection Agency
FM  Factory Mutual
FSSC  Federal Specification
HIS  Hydraulic Institute Standards
IEEE  Institute of Electrical and Electronics Engineers
IRI  Industrial Risk Insurers
ISO  Insurance Services Office
MCAA  Mechanical Contractors Association of America
NBS  National Bureau of Standards
NEBB  National Environmental Balancing Bureau
NEMA  National Electrical Manufacturers Association
NFPA  National Fire Protection Association
NOFI  National Oil Fuel Institute
NSC  National Safety Council
NSF  National Sanitation Foundation
OSHA  Occupational Safety and Health Administration
PDI  Plumbing and Drainage Institute

GENERAL CONDITIONS FOR MECHANICAL TRADES
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D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.09 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the work, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.10 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of quality, finish and design that is required. If the Contractors uses an “approved equal” alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.

B. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

C. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.
D. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer’s equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

E. If an alternative or substitute item results in a difference in quantity and arrangement of structure, piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

F. Equipment, material or devices submitted for review as a “substitution” shall meet the following requirements:

G. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

H. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
   a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution’s effect on the Contractor’s Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
f. Cost information, including a proposal of the net change, if any in the Contract Sum.

g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.

i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer; otherwise requests will be returned without action except to record noncompliance with these requirements.
   1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.
   2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
   3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.11 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 1 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review.
submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
   1. Allow ten business days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
   2. If an intermediate submittal is necessary, process the same as the initial submittal.
   3. Allow ten business days for reprocessing each submittal.
   4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Submittals shall be arranged in order of specification sections.
   1. Include the following information on the label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of Engineer.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Number, title and paragraph of appropriate Specification Section.
      i. Drawing number and detail references, as appropriate.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

F. Except for submittals for record, information or similar purposes, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility.

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.
1.12 SHOP DRAWINGS

A. Submit neatly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review all shop drawings to be incorporated in the Mechanical Contract.

C. Provide shop drawings for all devices specified under equipment specifications for all systems. Shop drawings shall include manufacturers’ names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures), of all shop drawings, catalog cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. When a submittal could involve more than one trade, e.g., valves, piping, etc., the submitted shall be separated by traded involved, ie. HVAC, plumbing, fire protection, etc.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

G. “No Exception Taken” rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings. Review of shop drawings shall not apply to quantity of material.

H. After shop drawings have been reviewed, with no exceptions taken, no further changes will be allowed without the written consent of the Engineer.
I. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

J. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

K. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

L. All submittals shall be made in electronic PDF format with searchable OCR (Optical Character Recognition) format. This excludes scanned and faxed materials.

1.13 COORDINATION DRAWINGS AND BIM MODEL

A. Coordination drawings are required for all mechanical and electrical trades. The content and procedures described in Division 01 shall be followed, with the additional requirements specifically for the mechanical and electrical trades as described in this Section. If a BIM model is not used on this project, the below requirements shall be accomplished in CAD.

B. Prepare coordination drawings accordance with Division 1, at 1 to 1 (full) scale prepared at ¼” = 1′-0” detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. The Contractor shall indicate the proposed locations of piping, conduit, ductwork, equipment, and materials. Include the following:
   a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   b. Equipment connections and support details.
   c. Exterior wall and foundation penetrations.
   d. Fire-rated wall and floor penetrations.
   e. Sizes and locations of required concrete pads and bases.

C. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

D. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

E. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
F. The Contractor and each subcontractor shall sign and date each coordination drawing prior to submission.

G. Work shall not be performed until coordination drawings have been approved by the architect and engineer.

H. Electronic copies of the MEP floor plans and/or BIM model are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic Drawing File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic Drawing File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic Drawing File Release Form is appended to the end of this specification section.

I. Review by Engineer of coordination drawings is limited to confirming that requirements for coordination and preparation of plans have been complied with by the Contractor and shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, Electrical and other related work.

1.14 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, HVAC piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. The two dimensional drawings are diagrammatic. They indicate general arrangements of mechanical systems and other work, and are intended to convey sufficient information for skilled contractors and tradespeople to furnish and install...
complete systems. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, provide all other components and materials to make the systems fully complete, coordinated with other systems and the structure and space available, and operational. Similarly, the drawings do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades in order to avoid interferences and to meet ceiling heights and other Architectural requirements. Establish and provide offsets, changes in direction, and exact routings to coordinate all systems. Where conflicts or potential conflicts exist and engineering guidance is desired, submit a “Request for Information” (RFI).

F. Controls contractor shall coordinate and sequences of operation with all other trades as necessary to provide a complete and functioning system.

1.15 QUALITY CONTROL

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled tradespeople, fitters, metal workers, welders, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of mechanical systems shall be performed by experienced, skilled tradespeople under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, professional manner. The Engineer reserves the right to reject any work which, in their opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.
1.16 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.17 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Utilities: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

F. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

G. Temporary Heat-Cool-Dehumidification: Provide temporary services required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations.
or elements being installed. Coordinate temporary services to produce the ambient condition required and minimize consumption of energy. The building’s permanent HVAC systems shall not be used for these purposes.

H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

I. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.18 Equipment Access

A. Appliances, controls devices, heat exchangers and HVAC system components that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. A level working space not less than 30 inches deep and 30 inches wide (762 mm by 762 mm) shall be provided in front of the control side to service an appliance.

1.19 BUILDING FLUSH-OUT

A. Building flush-out shall begin after construction ends and finishes are installed but prior to building occupancy. Prior to building flush-out, HVAC systems shall be balanced per Specification Section 23 05 93. Flush-out shall not occur until contractor receives permission to proceed from the Owner or Owner’s representative.

B. Building flush-out procedures shall include continuously operating all the building’s new ventilation systems at maximum design outside air flow rates. For constant volume HVAC systems, ventilation systems shall operate at maximum design supply air flow rates.

G. LEED REQUIREMENTS
1. Path 1. Before occupancy
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a. Install new filtration media and perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of gross floor area while maintaining an internal temperature of at least 60°F and no higher than 80°F and relative humidity no higher than 60%. Controls contractor to modify sequence of operations to allow for these conditions as needed.

Path 2. During occupancy

a. If occupancy is desired before the flush-out is completed, the space may be occupied only after delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,066,260 liters of outdoor air per square meter) of gross floor area while maintaining an internal temperature of at least 60°F (15°C) and no higher than 80°F (27°C) and relative humidity no higher than 60%. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic foot per minute (cfm) per square foot of outdoor air (1.5 liters per second per square meter of outdoor air) or the design minimum outdoor air rate determined in EQ Prerequisite Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin at least three hours before occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot of outdoor air (4,267,140 liters of outdoor air per square meter) has been delivered to the space.

H. Contractor shall include hourly trend log and record during duration of building flush out.

I. Log to include hours, airflow, temperature, and RH% of space and be summarized to confirm performance.

J. Install new filtration media at end of flush-out and reset controls sequence of operation as needed.

K. CT HIGH PERFORMANCE BUILDING REQUIREMENTS

1. After construction ends and with all interior finishes installed but prior to building occupancy, flush the building continuously for at least ten days with outside air while maintaining an internal temperature between 60°F and 78°F and relative humidity no higher than 60%. Do not —bake out‖ the building by increasing the temperature of the space. Alternatively, use the following strategy: Flush out each space separately until 3,500 cubic feet of outside air per square foot of floor space has been delivered to that space. The space shall then be ventilated at the rate of 0.3 cubic feet per minute per square foot of floor space or the design minimum outside air rate, whichever is greater. This shall be performed for a minimum of three hours prior to occupancy and then during occupancy until a total of 14,000 cubic feet of outside air per square foot of floor area has been delivered to that space.
a. Compliance Assistance for Optional Strategy: Perform a building flush-out by supplying outside air continuously for ten days while maintaining an internal temperature of at least 60°F but no warmer than 78°F and relative humidity no higher than 60%.

b. Alternative Compliance Pathway for Optional Strategy: Flush out each space separately with outside air until 3,500 cubic feet of outside air has been delivered for each square foot of floor area. Then ventilate the area at the rate of 0.3 cubic feet of outside air per square foot of floor space or the design outside air rate, whichever is greater, at least three hours prior to occupancy. Maintain that ventilation rate until a total of 14,000 cubic feet of outside air per square foot of floor areas has been delivered to the space.

L. Contractor shall include hourly log and record during duration of building flush out.

M. Log to include hours, airflow, temperature, and RH% of space and be summarized to confirm performance.

N. Install new filtration media at end of flush-out and reset controls sequence of operation as needed.

1.20 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, piping, heating, temperature control work, fire stopping, water heaters, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.

1.21 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workpeople and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in
handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by tradespeople or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.22 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer’s recommendations and is operating as intended by the manufacturer.

1.23 CLEANING

A. The Contractor shall thoroughly clean and flush all piping, ducts and equipment of all foreign substances, oils, burrs, solder, flux, etc., inside and out before being placed in operation.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all ducts and pipes shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.
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2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscur ing materials. Replace chipped or broken glass and other damaged transparent materials.

3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.


F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner’s property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner’s property, arrange for disposition of these materials as directed.

1.24 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, the contractor shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) days notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.

C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. The following equipment will require this inspection: pumps; air conditioning equipment, controls, air handling equipment, compressors, boilers etc. These letters shall be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.
F. Demonstration shall be recorded on USB Flash drive turned over to the Owner. Video recording shall be done in a professional manner with quality video (1080p resolution) and clear audible sound.

1.25 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 1 and as follows. The Contractor shall prepare up to six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 3-ring vinyl-covered binders, with pocket folders for folded sheet information and designation partitions with identification tabs. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing and operating instructions including lubrication charts and schedules.
5. Emergency and safety instructions.
6. Spare parts list.
8. Wiring diagrams.
9. Recommended "turn around" cycles.
10. Inspection procedures.
11. Approved Shop Drawings and Product Data.
12. Equipment Start-up Reports.
13. Temperature control diagrams and written sequences of operations.

C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, filter quantities and sizes, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.
1.26 ACCEPTANCES

A. The equipment, materials, quality, design and arrangement of all work installed under the Mechanical Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Mechanical Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Mechanical Sections. The intent to use the exact manufacturers and models specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of award of the Contract. In such instances, equipment substitutions may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Mechanical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.27 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistant location; provide access to record documents for the Engineer’s reference during normal working hours.

B. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items to be indicated include but are not limited to:

1. Dimensional change
2. Revision to drawing detail
3. Location and depth of underground utility
4. Revision to pipe routing
5. Revision to electrical circuitry
6. Actual equipment location
7. Duct size and routing
8. Location of concealed internal utility
9. Changes made by Change Order
10. Details not on original Contract Drawing
11. Information on concealed elements which would be difficult to identify or measure later

C. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

D. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

E. Note related Change Order numbers where applicable.

F. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

G. Final record documents shall be prepared in the latest electronic version and on USB Flash drive of all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.28 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:
   1. General close-out requirements included in Division 1.
   2. Specific requirements for warranties for the Work and products and installation that are specified to be warranted, are included in the individual Sections of Divisions-2 through -50.
   3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer’s disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.
1.29 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by
the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.

1. Refer to individual Sections of Divisions-2 through -50 for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
   2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
   3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.30 GUARANTEES

A. The Contractor shall guarantee all material and installation quality under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or installation quality shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineer's satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided.

1.31 PROJECT CLOSE-OUT

A. Submit specific warranties, quality bonds, maintenance agreements, final certifications and similar documents in accordance with Division 1.

B. Deliver tools, spare parts, extra stock, and similar items.

C. Complete start-up testing of systems, including measuring and documenting all required startup checklist requirements documented in installation and maintenance instructions by the equipment manufacturer, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and
remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

D. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

E. Field Observation Procedures: On receipt of a request for an Engineers Field Observation, the Engineer will advise the Contractor of unfulfilled requirements. The Engineer will advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Contractor shall submit written response to each corrective item including specific photos prior to final Engineering inspection.

1. The Engineer will repeat the Field Observation when requested and assured that the Work has been substantially completed.
2. Results of the completed list of unfulfilled items will form the basis of requirements for final acceptance.

END OF SECTION
Electronic Drawing File Release Form

DELIVERY OF FILES FOR:  

Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys’ fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____________________________________________  ________________________
Client’s Signature  Date

_____________________________________________
Company - Title

_____________________________________________
Architects’ Signature  Date

_____________________________________________
Firm - Title

_____________________________________________
Owner’s Signature  Date

_____________________________________________
Company - Title
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Design of expansion systems and anchors
B. Flexible pipe connectors.
C. Expansion joints and compensators.
D. Pipe Alignment Guides
E. Swivel Joints
F. Pipe Anchors

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Division 23 specifications

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Inch Standard.
C. ASME B16.11 - Forged Fittings, Socket-welding and Threaded.
D. ASME B31.9 – Building Services Piping
E. ASME Section IX – Boiler and Pressure Vessel Code- Welding and Brazing Qualifications.
G. AWS D1.1 – Structural Welding Code- Steel.
H. EJMA (STDS) - EJMA Standards.
I. FM (AG) - FM Approval Guide.
1.04 DESIGN REQUIREMENTS

A. Provide design, details, work and equipment required for expansion and contraction of hot water and steam piping systems. Verify anchors, guides, and expansion joints provide and adequately protect system.

B. Provide structural work and equipment required for expansion and contraction of piping. Verify anchors, guides, and expansion joints provide and adequately protect system.

C. Expansion Compensation Design Criteria:
   1. Installation Temperature: 50°F.
   2. Hot Water Heating System Temperature: 210°F.
   3. Radiant Floor Heating System Temperature: 120°F.
   4. Ground Water System Temperature: 90°F.
   5. Low/ Medium Pressure Steam Temperature: 320°F.
   6. High Pressure Steam Temperature: 400°F.
   7. Refrigerant System Temperature: Refer to manufacturers design literature.
   8. Safety Factor: 30%.

1.05 SUBMITTALS

A. Pipe Expansion Analysis, Design and Certification:
   1. Provide pipe expansion and anchoring calculations for all refrigerant, steam and hot water piping systems including connections to equipment and to the structure. Piping layouts and associated calculations must be stamped by a registered professional engineer with at least five years of pipe expansion experience, licensed in the state of the job location.

   2. Analysis must indicate calculated dead loads, active expansion loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/ or welded length. All expansion and anchoring devices shall be designed to accept the forces as calculated.

B. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints. Indicate installed locations of flexible pipe connectors, expansion joints, anchors and guides.

C. Product Data:
   1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.

   2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
D. Manufacturer’s Instructions: Indicate manufacturer’s installation instructions, special procedures, and external controls.

E. Maintenance Data: Include adjustment instructions.

F. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.
   1. Extra Packing for Packed Expansion Joints: One set for each joint.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years’ experience.

B. Installer: Company specializing in performing work of this section with minimum five years’ experience.

C. Design expansion compensating system under direct supervision of a Professional Engineer experienced in design of this work and licensed in state which the work will occur.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Mason Industries

B. The Metraflex Company

C. UniSource Manufacturing

2.02 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Inner Hose: Bronze.


C. Pressure & Temperature Rating: 125 psi and 450°F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

2.03 FLEXIBLE PIPE CONNECTORS - COPPER PIPING SERVING WATER SYSTEMS

A. Inner Hose: Bronze.
B. Exterior Sleeve: Braided bronze.
C. Pressure & Temperature Rating: 125 psi and 450°F.
D. Joint: Flanged.
E. Size: Use pipe sized units.
F. Maximum offset: 3/4 inch on each side of installed center line.
G. Application: Copper piping serving water-based systems.

2.04 FLEXIBLE PIPE CONNECTORS - COPPER PIPING SERVING REFRIGERANT SYSTEMS

A. Inner Hose: Stainless Steel.
B. Exterior Sleeve: Braided 304 Stainless Steel
C. Pressure Rating: 650 psi.
D. Joint: Brazed.
E. Size: Use pipe sized units.
F. Maximum offset: 3/4 inch on each side of installed center line.
G. Application: Refrigerant Piping.

2.05 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A. Pressure & Temperature Rating: 125 psi and 400°F.
C. Maximum Extension: 1/4 inch.
D. Joint: Flanged.
E. Size: Use pipe sized units.
F. Application: Steel piping 3 inches and under.

2.06 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

A. Pressure & Temperature Rating: 125 psi and 400°F.
B. Maximum Compression: 15/16 inch.
C. Maximum Extension: 5/16 inch.
D. Maximum Offset: 1/8 inch.
E. Joint: Flanged.
F. Size: Use pipe sized units.
G. Accessories: Internal flow liner.
H. Application: Steel piping over 2 inches.

2.07 EXPANSION JOINTS - DOUBLE SPHERE, FLEXIBLE COMPENSATOR
A. Body: Multi-Layered Kevlar with EPDM.
B. Pressure & Temperature Rating, Sizes 3/4 Inch to 1-1/4” Inch: 150 psi and 210°F.
C. Pressure & Temperature Rating, Sizes 1-1/2 Inch to 12 Inch: 150 psi and 250°F.
D. Pressure & Temperature Rating, Sizes 14 Inch to 24 Inch: 105 psi and 250°F.
E. Maximum Compression: 1/2 inch.
F. Maximum Elongation: 3/8 inch.
G. Maximum Offset: 3/8 inch.
H. Maximum Angular Movement: 15 degrees.
I. Joint: Tapped steel flanges.
J. Size: Use pipe sized units.
K. Accessories: Control cables.
L. Application: Steel piping 2 inches and over.

2.08 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE
A. Construction: Bronze with anti-torque device, limit stops, internal guides.
B. Pressure & Temperature Rating: 125 psi and 400°F.
D. Maximum Extension: 1/4 inch.
E. Joint: Soldered.
EXPANSION JOINTS - LOW PRESSURE COMPENSATOR WITH TWO-PLY BRONZE BELLOWS

A. Working Pressure: 75 psi.
B. Maximum Temperatures: 250°F.
C. Maximum Compression: 1/2 inch.
E. Joint: Soldered.
F. Size: Use pipe sized units.
G. Application: Copper or steel piping 3 inches and under.

EXPANSION JOINTS - STEEL WITH PACKED SLIDING SLEEVE

A. Working Pressure and Temperature: Class 150.
B. Joint: Flanged.
C. Size: Use pipe sized units.
D. Application: Steel piping 2 inches and over.

EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE

A. Working Pressure: 125 psi.
B. Maximum Temperature: 250°F.
C. Joint: Flanged.
D. Size: Use pipe sized units.
E. Application: Copper or steel piping 2 inches and over.

EXPANSION LOOPS - HOSE AND BRAID

A. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support bracket and air release or drain plug.
B. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
C. **Flexible Connectors**: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. **Maximum Allowable Working Pressure & Temperature**: 150 psig at 120°F.
2. **Accommodate the Following**:
   a. **Axial Deflection in Compression and Expansion**: To be determined by the Professional Engineer providing calculations.
   b. **Lateral Movement**: To be determined by the Professional Engineer providing calculations.
   c. **Angular Rotation**: 15 degrees.
   d. **Force developed by 1.5 times specified maximum allowable operating pressure**.
3. **End Connections**: Same as specified for pipe jointing.
4. **End Connections**: Flanged ductile iron; complying with ASME B16.1 Class 125.
5. **End Connections**: Threaded; complying with ASME B16.11.
6. **Provide necessary accessories including, but not limited to, swivel joints.**

**2.13 EXPANSION JOINTS - EXTERNALLY PRESSURIZED EXPANSION JOINTS**

A. **Construction**: Stainless steel with anti-torque device, limit stops, internal guides.
B. **Maximum Allowable Working Pressure & Temperature**: 150 psig at 700°F.
C. **Maximum Axial Compression**: 4 inches.
D. **End Connections**: Flanged by weld end.
E. **Size**: Use pipe sized units.
F. **Application**: Steel piping 2 inches and over.

**2.14 PIPE ALIGNMENT GUIDES**

A. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inches travel

**2.15 SWIVEL JOINTS**

A. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

**2.16 PIPE ANCHORS**

A. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 PSI and the design shall be balanced for equal resistance in any direction.
PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on:
   1. Pipes connected to pumps.
   2. Refrigerant piping connections to equipment per recommendations of equipment manufacturer.
   3. Pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Rigidly anchor pipe to building structure. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

G. For systems using grooved piping systems, provide with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation.

H. Provide piping expansion loops at all building expansion joints as indicated on drawings.

I. Provide piping expansion joints or expansion loops as indicated below:
   1. Provide and install pipe expansion joints or expansion loops at all conditions listed below and as required to minimize stress on the piping systems.
   2. Provide pipe guides at inlet and outlet of each expansion joint and expansion loop.
   3. Where expansion joints or loops are required, provide pipe anchors at ends of each straight length of run.
   4. Provide and install expansion joints, expansion loops, pipe guides and anchors per ASHRAE guidelines and manufacturer's recommendations.
<table>
<thead>
<tr>
<th>PIPING SYSTEM</th>
<th>PIPING MATERIAL</th>
<th>PIPE SIZE</th>
<th>Condition Requiring expansion joint or expansion loop (all conditions assume “offset leg” at end of runs are minimum 12’0” long)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot water supply and return (all temperatures)</td>
<td>Copper</td>
<td>Up to 3 inches</td>
<td>All straight sections of piping over 90’ long. All straight sections of piping where “offset leg” is less than 12’0”</td>
</tr>
<tr>
<td>Hot water supply and return Steam supply and return (all temperatures)</td>
<td>Steel</td>
<td>Up to 2 inches</td>
<td>All straight sections of piping over 140’ long.</td>
</tr>
<tr>
<td>Hot water supply and return Steam supply and return (all temperatures)</td>
<td>Steel</td>
<td>2” to 4”</td>
<td>All straight sections of piping over 90’ long</td>
</tr>
<tr>
<td>Hot water supply and return Steam supply and return (all temperatures)</td>
<td>Steel</td>
<td>5” to 8”</td>
<td>All straight sections of piping over 45’ long</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Division 07 – Thermal and Moisture Protection.

C. Division 09 - Finishes.

D. Section 23 0523 - General-Duty Valves for HVAC Piping.

E. Section 23 0553 - Identification for HVAC Piping and Equipment: Piping identification.

F. Section 23 0716 - HVAC Equipment Insulation.

G. Section 23 0719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)


1.04 SUBMITTALS

A. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

B. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.

1. Extra Valve Stem Packings: Two for each type and size of valve.
1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Materials
   1. Galvanized-Steel Sheet: 0.0239-inch 0.6-mm minimum thickness; round tube closed with longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Flexicraft Industries; PipeSeal.
   2. Metraflex
   3. Link-Seal
   4. Substitutions: See Division - 01 General Requirements.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 GENERAL

A. Lay out penetration and sleeve openings in advance, to permit provision in work. Coordinate work with architectural and structural work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed. Remedial work includes core drilling (see requirements below) for penetrations if walls are poured, or otherwise constructed, without required sleeves. Provide core drilling (see requirements below) of existing construction. Do not penetrate structural members without Structural Engineer’s/Architect’s written approval.

B. Sleeve installation shall meet NFPA-101 requirements, UL rated assemblies requirements, and materials requirements of these specifications. Submit a list of the UL listed details that the Contractor intends on using on this project in all rated assemblies.

C. Sleeves that penetrate outside walls, basement slabs, footings and beams shall be waterproof. Sleeves that penetrate floors shall be fireproof and waterproof.

D. Identify unused sleeves and slots for future installation. Fill slots, sleeves and other openings in floors or walls if not used. Fill spaces in openings after installation of pipe, duct, conduit or cable. Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes. Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke and fumes.

E. Do not support piping risers or conduit on sleeves.

F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 for materials.

G. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements. Verify final equipment locations for roughing-in.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.03 APPLICATIONS

A. Provide sleeves when penetrating footings, floors, walls, partitions, and other building components as follows:
1. Interior walls, partitions, and floors: galvanized-steel sheet, unless steel or brass sleeves are specified elsewhere.

2. Below Grade Exterior Walls: Zinc coated or cast iron pipe with mechanical sleeve seals. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

3. Above Grade Exterior Walls: steel pipe sleeve with mechanical sleeve seals.

4. Mechanical, Laundry, and Animal Room Floors above Basement: Galvanized steel pipe or black iron pipe with asphalt coating. Connect sleeve with floor plate except in mechanical rooms.

5. Concrete and masonry walls, concrete floor and roof slabs: galvanized-steel sheet

6. Floors with membrane waterproofing: stack sleeve fittings

3.04 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Install sleeves that are large enough to provide 1/4 inch annular clear space between sleeve and pipe or pipe insulation. Sleeves for insulated pipe and duct in non-fire rated construction shall accommodate continuous insulation without compression. Sleeves and/or penetrations in fire rated construction shall be packed with fire rated material that shall maintain the fire rating of the wall. Seal ends of penetrations to provide continuous vapor barrier where insulation is interrupted.

E. Where pipes passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.

F. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.
H. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber conforming to ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Division 07 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with Mechanically expandable chloroprene inserts with mastic-sealed components.

I. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

J. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Division 07 to prevent the spread of fire, smoke, and gases.

K. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer’s recommendations.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
3.05 CORE DRILLING

A. Core drilling shall be avoided in new construction. Set sleeves prior to installation of structure for passage of pipes, conduit and ducts. Where core drilling is unavoidable (e.g. when individual sleeves are not installed or incorrectly located) or required by renovation projects, locate required openings prior to coring and submit locations for review.

B. Coordinate openings with other Divisions.

C. Do not disturb existing systems. Protect areas from damage.

D. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.06 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.
B. General requirements.
C. Angle valves.
D. Globe valves.
E. Ball valves.
F. Butterfly valves.
G. Check valves.
H. Gate valves.
I. Plug valves.
J. Chainwheels.

1.02 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Nonrising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. SWP: Steam working pressure.
I. TFE: Tetrafluoroethylene.
1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding.

B. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).


D. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.

E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

G. ASME B16.34 - Valves - Flanged, Threaded and Welding End.

H. ASME B31.1 - Power Piping.

I. ASME B31.9 - Building Services Piping.

J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications.


P. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars.


R. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

S. AWWA C606 - Grooved and Shouldered Joints.

T. MSS SP-45 - Bypass and Drain Connections.

U. MSS SP-67 - Butterfly Valves.
V. MSS SP-68 - High Pressure Butterfly Valves with Offset Design.
W. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
X. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
Y. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service.
Z. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
AA. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.
DD. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
EE. MSS SP-125 - Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves.

1.04 SUBMITTALS
A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner’s name and registered with manufacturer.
C. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1.05 QUALITY ASSURANCE
A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
B. Welding Materials and Procedures: Conform to ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:
   1. Handle large valves with sling, modified to avoid damage to exposed parts.
   2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 GENERAL

A. See Drawings for specific valve locations.
B. Refer to Part 3 for applications.
C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
B. Valve Sizes: Match upstream piping unless otherwise indicated.
C. Valve Actuator Types:
   1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
   2. Handwheel: Valves other than quarter-turn types.
   3. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
   5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
4. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:
5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:

H. Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:
1. Comply with MSS SP-80, Type 1.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze or PTFE
5. Packing: Asbestos free.
6. Handwheel: Malleable iron or bronze.
7. Manufacturers:
   a. Nibco Inc.
   b. Grinnell
   c. Crane Co.
   d. Milwaukee Valve Co.
2.04 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig; and Class 250: CWP Rating: 500 psig:
1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.
7. Manufacturers:
   a. Nibco Inc.
   b. Grinnell
   c. Crane Co.
   d. Milwaukee Valve Co.

2.05 BRASS BALL VALVES

A. Two Piece, Full Port, Ball Valves with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
5. Ends: Threaded.
6. Seats: PTFE
7. Stem: Stainless Steel.
8. Ball: Chrome-plated brass or Stainless steel, vented
9. Manufacturers:
   a. Apollo
   b. Nibco
   c. Watts

B. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
5. Ends: Threaded.
6. Seats: PTFE
7. Stem: Stainless steel.
9. Manufacturers:
   a. Apollo
   b. Nibco
   c. Watts

2.06 BRONZE BALL VALVES

A. Two Piece, Full Port, Bronze Ball Valves with Stainless-Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Bronze, brass or stainless steel
8. Ball: Chrome plated brass or stainless steel, vented
9. Manufacturers:
   a. Apollo
   b. Nibco
   c. Watts
   d. Bray International

B. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel.
9. Manufacturers:
   a. Apollo
   b. Nibco
   c. Watts
   d. Bray International

### 2.07 CARBON STEEL BALL VALVES

A. Class 300, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
2. CWP Rating: 720 psig.
3. Body: Carbon steel, ASTM A216/A216M, Type WCB.
5. Seats: PTFE.
8. Manufacturers:
   a. 
   b. 
   c. Substitutions: See Division 01 - General Requirements.

### 2.08 IRON BALL VALVES

A. Split Body, Full Port:
1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
5. Seats: PTFE.
8. Manufacturers:
   a. 
   b. 
   c. 
   d. Substitutions: See Division 01 - General Requirements.

2.09 IRON, GROOVED-END BALL VALVES

A. Class 200:
1. CWP Rating: 600 psig.
2. Body: Ductile iron; ASTM A536, Grade 65-45-12.
3. Ends: Grooved.
7. Manufacturers:
   a. __________
   b. 
   c. 
   d. Substitutions: See Division 01 - General Requirements.

2.10 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.
7. Manufacturers:
   a. Nibco, Inc.
   b. Crane Co.
   c. Grinnell
   d. Hammond Valve
   e. Milwaukee Valve Co.
   f. Bray International

2.11 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig, 300 psig: 8 NPS or smaller, 200 psig: 10 NPS or larger.
1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.
6. Manufacturers:
   a. Nibco, Inc.
   b. Crane Co.
   c. Grinnell
   d. Hammond Valve
   e. Milwaukee Valve Co.
   f. Bray International

2.12 HIGH-PERFORMANCE SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead end service without downstream flange.
   1. Comply with MSS SP-68.
   4. Seat: Metal or reinforced PTFE.
   5. Offset stem: Stainless steel.
   6. Disc: 316 Stainless Steel
   7. Manufacturers:
      a. Nibco, Inc.
      b. Crane Co.
      c. Grinnell
      d. Hammond Valve
      e. Milwaukee Valve Co.
      f. Bray International

2.13 BRONZE LIFT CHECK VALVES

A. Class 125:
   1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat, Type 2, Nonmetallic Disc to Metal Seat.
   2. CWP Rating: 200 psig.
   3. Design: Vertical flow.
   5. Ends: Threaded.
   6. Disc (Type 1): Bronze.
   7. Disc (Type 2): NBR or PTFE.
   8. Manufacturers:
      a. Crane Co.
      b. Nibco, Inc.
      c. Milwaukee Valve Co.
      d. Mueller Steam Specialty
2.14 BRONZE SWING CHECK VALVES

   1. Comply with MSS SP-80, Type 3.
   2. Body Design: Horizontal flow.
   4. Ends: Threaded.
   5. Disc: Bronze.
   6. Manufacturers:
      a. Crane Co.
      b. Nibco, Inc.
      c. Milwaukee Valve Co.

2.15 IRON SWING CHECK VALVES

   1. Comply with MSS SP-71, Type I.
   2. Design: Clear or full waterway with flanged ends.
   3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
   4. Trim: Bronze.
   5. Disc Holder: Bronze.
   6. Disc: PTFE or TFE.

B. Manufacturers:
   a. Crane Co.
   b. Nibco, Inc.
   c. Milwaukee Valve Co.

2.16 IRON, CENTER-GUIDED SILENT CHECK VALVES

A. Class 125, Globe:
   1. Comply with MSS SP-125.
   2. 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.
   3. 14 NPS to 24 NPS, CWP Rating: 150 psig.
   5. Style: Spring loaded.
   7. Metal Seat: Bronze.
   8. Resilient Seat: EPDM, NBR
   9. Manufacturers:
      a. Nibco, Inc
      b. Mueller Steam Specialty
      c. Watts
B. Class 150, Globe:
   1. Comply with MSS SP-125.
   2. 2-1/2 NPS to 12 NPS, CWP Rating: 300 psig.
   3. 14 NPS to 24 NPS, CWP Rating: 250 psig.
   5. Style: Spring loaded.
   7. Metal Seat: Bronze.
   8. Resilient Seat: EPDM, NBR
   9. Manufacturers:
      a. Nibco, Inc.
      b. Mueller Steam Specialty
      c. Watts

2.17 BRONZE GATE VALVES

A. Non-Rising Stem (NRS), Rising Stem (RS):
   1. Comply with MSS SP-80, Type I.
   5. Ends: Threaded.
   7. Disc: Solid wedge; bronze.
   9. Handwheel: Malleable iron, bronze, or aluminum.
   10. Manufacturers:
        a. Crane Co.
        b. Milwaukee Valve Co.
        c. Watts
        d. Nibco, Inc.

2.18 IRON GATE VALVES

A. NRS, OS & Y
   1. Comply with MSS SP-70, Type I.
   2. Class 125: 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.
   8. Trim: Bronze.
   11. Manufacturers:
        a. Crane Co.
        b. Milwaukee Valve Co.
2.19 ECCENTRIC PLUG VALVES

A. Resilient Seating with Flanged Ends.
   1. Comply with MSS SP-108.
   2. CWP Rating: 175 psig minimum.
   3. Body and Plug: Gray or ductile iron.
   4. Bearings: Oil-impregnated bronze or Stainless Steel.
   5. Stem-Seal Packing: Asbestos free.
   7. Manufacturers:
      a. Mueller
      b. Stockham
      c. DeZurik

2.20 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to ball, butterfly, plug valve stems.
   3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
   5. Manufacturers:
      a. Babbitt Steam Specialty Co.
      b. Roto Hammer Industries
      c. Trumbull Industries

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.
3.02 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 VALVE APPLICATION

A. Valves on condenser water, chilled water, hot water and glycol services shall be as shown in the following tables. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball, butterfly, or gate valves.
   3. Throttling Service except Steam: Globe or butterfly valves.
   4. Pump-Discharge Check Valves:
      a. NPS 2 and Smaller: Spring wafer check valve with bronze disc.
      b. NPS 2-1/2 and Larger: Iron, center-guided, metal-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves with end connections as indicated in the tables. For applications not listed in the tables select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
   2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
   3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.
   4. For Steel Piping, NPS 5 and Larger: Flanged ends.

END OF SECTION
## General-Duty Valves for HVAC Piping

### Glycol, Chilled and Condenser Water Service

Maximum 150°F and 150 psig (1/2 inch - 12 inches), 125 psig (14 inches - 24 inches)

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Application</th>
<th>Type</th>
<th>Size (inches)</th>
<th>Body/Seat Body/Trim</th>
<th>Minimum Rating $^{1,2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valve</td>
<td>Isolation (with locking handle)</td>
<td>Full Port 3-pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td>and Modulation</td>
<td>Full Port 2 pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>Not Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globe Valve</td>
<td>ATC Modulation</td>
<td>Control Valve</td>
<td>1/2 - 2</td>
<td>Bronze/Metal</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 1/2 - 6</td>
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<td></td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>Isolation and Modulation</td>
<td>General Service</td>
<td>2 1/2 - 12</td>
<td>Ductile Iron/EPDM</td>
<td>175 psig CWP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150 psig bi-directional</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>shutoff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General Service</td>
<td>14 - 24</td>
<td>Ductile Iron/EPDM</td>
<td>150 psig CWP</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>150 psig bi-directional</td>
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<td></td>
<td>shutoff</td>
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<td></td>
<td></td>
<td></td>
<td>150 psig dead end service</td>
</tr>
<tr>
<td>Plug Valve</td>
<td>Manual Balancing</td>
<td>Non-lubricated</td>
<td>3 - 12</td>
<td>Steel/Iron</td>
<td>Class 125</td>
</tr>
<tr>
<td>Check Valve</td>
<td>Pumps</td>
<td>Silent</td>
<td>1/2 - 2</td>
<td>Bronze/Bronze</td>
<td>200 psig WOG</td>
</tr>
<tr>
<td></td>
<td>Silent Globe</td>
<td>2 1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 125</td>
<td></td>
</tr>
<tr>
<td>Piping</td>
<td>Y-Pattern Swing</td>
<td>1/2 - 2</td>
<td>Bronze/Bronze</td>
<td>200 psig WOG</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 125</td>
<td></td>
</tr>
<tr>
<td>Strainer</td>
<td>Control Valves and Flow Meters</td>
<td>Y-Type</td>
<td>1/2 - 2</td>
<td>Bronze/Stainless</td>
<td>200 psig WOG</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>(1/16 inch dia.)</td>
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<td>Class 125</td>
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<td>Class 125</td>
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</tr>
<tr>
<td>Angle Suction Diffuser End Suction Pumps</td>
<td>2 - 12</td>
<td>Iron/Stainless (3/16 inch dia.)³ Start Up Strainer = 16 Mesh Bronze</td>
<td>Class 125</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].

2. SWP=Steam Working Pressure  CWP=Cold Water Working Pressure  WSP=Working Steam Pressure  WOG=Water, Oil or Gas  Class=ANSI Standard

3. Use 1/8 inch dia for plate heat exchanger application.

4. Coordinate connection type with piping system.
### General-Duty Valves for HVAC Piping

**Project No. 056-0052 A / 01/07/2022**

**GLYCOL, CHILLED AND CONDENSER WATER SERVICE**

Maximum 150°F and 275 psig (1/2 inch - 24 inches)

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Application</th>
<th>Type</th>
<th>Size (inches)</th>
<th>Body/Seat Body/Trim</th>
<th>Minimum Rating¹,²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valve</td>
<td>Isolation (with locking handle) and Modulation</td>
<td>Full Port 2 pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>Not Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globe Valve</td>
<td>ATC Modulation</td>
<td>Control Valve</td>
<td>1/2 - 2</td>
<td>Bronze/Metal</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 6</td>
<td>Bronze/Metal</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>Isolation and Modulation</td>
<td>High Performance</td>
<td>2-1/2 - 24</td>
<td>Carbon Steel/PTFE</td>
<td>285 psig CWP</td>
</tr>
<tr>
<td>Plug Valve</td>
<td>Manual Balancing</td>
<td>Non-lubricated</td>
<td>3 - 12</td>
<td>Steel/Iron</td>
<td>Class 300</td>
</tr>
<tr>
<td>Check Valve</td>
<td>Pumps</td>
<td>Silent</td>
<td>1 - 2</td>
<td>Bronze/Bronze</td>
<td>Class 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silent Globe</td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Piping</td>
<td>1/2 - 2</td>
<td>Bronze/Bronze</td>
<td>Class 300</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td>Strainer</td>
<td>Control Valves and Flow Meters</td>
<td>Y-Type</td>
<td>1/2 - 2</td>
<td>Bronze/Stainless (1/16 inch dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
<td>Iron/Stainless (1/16 inch dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td>Iron/Stainless (1/8 inch dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pump Suction</td>
<td>1/2 - 2</td>
<td>Iron/Stainless (1/16 inch dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
<td>Iron/Stainless (3/16 inch dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td>Iron/Stainless (1/4 inch dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angle Suction Diffuser End Suction Pumps</td>
<td>2 - 12</td>
<td>Iron/Stainless (3/16 inch dia.)³</td>
<td>Start Up Strainer = 16 Mesh Bronze</td>
</tr>
</tbody>
</table>

1. These are minimum ratings. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to “Pressure-Temperature...
Ratings - Non Shock” tables.

2. SWP=Steam Working Pressure   CWP=Cold Water Working Pressure
   WSP=Working Steam Pressure    WOG=Water, Oil or Gas
   Class=ANSI Standard

3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.
<table>
<thead>
<tr>
<th>Specialty</th>
<th>Application</th>
<th>Type</th>
<th>Size (inches)</th>
<th>Body/Seat Body/Trim</th>
<th>Minimum Rating(^1,2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valve</td>
<td>Isolation (with locking handle) and Modulation</td>
<td>Full Port 2 pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>Not Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globe Valve</td>
<td>ATC Modulation</td>
<td>Control Valve</td>
<td>1/2 - 2</td>
<td>Bronze/Metal</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bronze/Metal</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>Isolation and Modulation High Performance</td>
<td></td>
<td>2-1/2 - 24</td>
<td>Carbon Steel/PTFE</td>
<td>740 psig CWP</td>
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<tr>
<td>Plug Valve</td>
<td>Manual Balancing</td>
<td>Non-lubricated</td>
<td>3 - 12</td>
<td>Steel/Iron</td>
<td>Class 300</td>
</tr>
<tr>
<td>Check Valve</td>
<td>Pumps</td>
<td>Silent</td>
<td>1 - 2</td>
<td>Bronze/Bronze</td>
<td>Class 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silent Globe</td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td>Piping</td>
<td>Y-Pattern Swing</td>
<td></td>
<td>1/2 - 2</td>
<td>Bronze/Bronze</td>
<td>Class 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Iron/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td>Strainer</td>
<td>Control Valves and Flow Meters</td>
<td>Y-Type</td>
<td>1/2 - 2</td>
<td>Bronze/Stainless (1/16&quot; dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Iron/Stainless (1/16&quot; dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Iron/Stainless (1/8&quot; dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td>Pump Suction</td>
<td>In-Line Y-Type</td>
<td></td>
<td>1/2 - 2</td>
<td>Iron/Stainless (1/16&quot; dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Iron/Stainless (3/16&quot; dia.) (^3)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Iron/Stainless (¼&quot; dia.) (^3)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td>Angle Suction</td>
<td></td>
<td>2 - 12</td>
<td>Iron/Stainless (3/16&quot; dia.) (^3)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td>Diffuser End Suction Pumps</td>
<td></td>
<td></td>
<td></td>
<td>Start Up Strainer = 16 Mesh Bronze</td>
</tr>
</tbody>
</table>

1. These are minimum ratings. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables.

2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure
WSP=Working Steam Pressure  WOG=Water, Oil or Gas
Class=ANSI Standard

3. Use 1/8 inch dia for plate heat exchanger application.
4. Coordinate connection type with piping system.
# GENERAL-DUTY VALVES FOR HVAC PIPING

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Application</th>
<th>Type</th>
<th>Size (inches)</th>
<th>Body/Seat, Body/Trim</th>
<th>Minimum Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valve</td>
<td>Isolation (with locking handle) and Modulation</td>
<td>Full Port 3-pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full Port 2 pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>Not Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globe Valve</td>
<td>ATC Modulation</td>
<td>Control Valve</td>
<td>1/2 - 2</td>
<td>Bronze/Metal</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 6</td>
<td>Bronze/Metal</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>Isolation and Modulation</td>
<td>General Service</td>
<td>2-1/2 - 12</td>
<td>Ductile Iron/EPDM</td>
<td>200 psig CWP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>14 - 24</td>
<td>Ductile Iron/EPDM</td>
<td>150 psig CWP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150 psig bi-directional shutoff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150 psig dead end service</td>
</tr>
<tr>
<td>Plug Valve</td>
<td>Manual Balancing</td>
<td>Non-lubricated</td>
<td>3 -12</td>
<td>Steel/Iron</td>
<td>Class 125</td>
</tr>
<tr>
<td>Check Valve</td>
<td>Pumps</td>
<td>Silent</td>
<td>1/2 - 2</td>
<td>Bronze/Bronze</td>
<td>200 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silent Globe</td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 125</td>
</tr>
<tr>
<td>Piping</td>
<td>Y-Pattern Swing</td>
<td></td>
<td>1/2 - 2</td>
<td>Bronze/Bronze</td>
<td>200 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 125</td>
</tr>
<tr>
<td>Strainer</td>
<td>Control Valves and Flow Meters</td>
<td>Y-Type</td>
<td>1/2 - 2</td>
<td>Bronze/Stainless (1/16&quot; dia.)</td>
<td>200 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
<td>Iron/Stainless (1/16&quot; dia.)</td>
<td>Class 125</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td>Iron/Stainless (1/8&quot; dia.)</td>
<td>Class 125</td>
</tr>
<tr>
<td>Pump Suction</td>
<td>In-Line Y-Type</td>
<td></td>
<td>1/2 - 2</td>
<td>Bronze/Stainless (1/16&quot; dia.)</td>
<td>200 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
<td>Iron/Stainless (3/16&quot; dia.)</td>
<td>Class 125</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td>Iron/Stainless (¼&quot; dia.)</td>
<td>Class 125</td>
</tr>
<tr>
<td></td>
<td>Angle Suction</td>
<td></td>
<td>2 - 12</td>
<td>Iron/Stainless (3/16&quot; dia.)</td>
<td>Class 125</td>
</tr>
</tbody>
</table>

**GLYCOL AND HOT WATER SERVICE**

Maximum 250°F and 175 psig (½”-12“)/125 psig (14”-24“)
<table>
<thead>
<tr>
<th></th>
<th>Diffuser End Suction Pumps</th>
<th>Start Up Strainer = 16 Mesh Bronze</th>
</tr>
</thead>
</table>

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].

2. SWP=Steam Working Pressure  CWP=Cold Water Working Pressure  
   WSP=Working Steam Pressure  WOG=Water, Oil or Gas  
   Class=ANSI Standard

3. Use 1/8 inch dia for plate heat exchanger application.

4. Coordinate connection type with piping system.
<table>
<thead>
<tr>
<th>Specialty</th>
<th>Application</th>
<th>Type</th>
<th>Size (inches)</th>
<th>Body/Seat, Body/Trim</th>
<th>Minimum Rating1,2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valve</td>
<td>Isolation (with locking handle) and Modulation</td>
<td>Full Port 3-pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full Port 2 pc.</td>
<td>1/2 - 2</td>
<td>Bronze/Teflon</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td>Gate Valve</td>
<td>Not Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Globe Valve</td>
<td>ATC Modulation</td>
<td>Control Valve</td>
<td>1/2 - 2</td>
<td>Bronze/Metal</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 6</td>
<td>Bronze/Metal</td>
<td>600 psig WOG</td>
</tr>
<tr>
<td>Butterfly Valve</td>
<td>Isolation and Modulation High Performance</td>
<td>2-1/2 - 6</td>
<td>285 psig CWP</td>
<td>Steel/PTFE</td>
<td></td>
</tr>
<tr>
<td>Plug Valve</td>
<td>Manual Balancing Non-lubricated</td>
<td>3 - 12</td>
<td>Steel/Iron</td>
<td>Class 250</td>
<td></td>
</tr>
<tr>
<td>Check Valve</td>
<td>Pumps</td>
<td>Silent</td>
<td>1 - 2</td>
<td>Bronze/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td>Silent Globe</td>
<td></td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td>Piping</td>
<td>Y-Pattern Swing</td>
<td>1 - 2</td>
<td>Bronze/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 24</td>
<td>Iron/Bronze</td>
<td>Class 250</td>
</tr>
<tr>
<td>Strainer</td>
<td>Control Valves and Flow Meters</td>
<td>Y-Type</td>
<td>1/2 - 2</td>
<td>Bronze/Stainless (20 mesh)</td>
<td>400 psi WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
<td>Iron/Stainless (1/16&quot; dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td>Iron/Stainless (1/8&quot; dia.)</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td>Pump Suction</td>
<td>In-Line Y-Type</td>
<td>1/2 - 2</td>
<td>Bronze/Stainless (1/16&quot; dia.)</td>
<td>400 psig WOG</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-1/2 - 4</td>
<td>Iron/Stainless (3/16&quot; dia.)³</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 - 24</td>
<td>Iron/Stainless (3/4&quot; dia.)³</td>
<td>Class 250</td>
</tr>
<tr>
<td></td>
<td>Angle Suction Diffuser End Suction Pumps</td>
<td></td>
<td>2 - 12</td>
<td>Iron/Stainless (3/16&quot; dia.)³ Start Up Strainer = 16 Mesh Bronze</td>
<td>Class 250</td>
</tr>
</tbody>
</table>

1. These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve.
<table>
<thead>
<tr>
<th>Setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to &quot;Pressure-Temperature Ratings - Non Shock&quot; tables and &quot;Adjusted Pressure Ratings&quot; for copper tube, soldered end valves [and strainers].</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. SWP=Steam Working Pressure CWP=Cold Water Working Pressure WSP=Working Steam Pressure WOG=Water, Oil or Gas Class=ANSI Standard</td>
</tr>
<tr>
<td>3. Use 1/8 inch dia for plate heat exchanger application.</td>
</tr>
<tr>
<td>4. Coordinate connection type with piping system.</td>
</tr>
<tr>
<td>Specialty</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Ball Valve</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Gate Valve</td>
</tr>
<tr>
<td>Globe Valve</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Butterfly Valve</td>
</tr>
<tr>
<td>Plug Valve</td>
</tr>
<tr>
<td>Check Valve</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Piping</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Strainer</td>
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<td></td>
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<td></td>
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<tr>
<td>Pump Suction</td>
</tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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3. Use 1/8 inch dia for plate heat exchanger application.

4. Coordinate connection type with piping system.

3.04 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
   1. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.
   3. Orient plate-type, center-guided into horizontal or vertical position, between flanges.

E. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe hangers and supports.
B. Duct hangers and supports
C. Hanger rods.
D. Inserts.
E. Flashing.
F. Formed steel channel.
G. Equipment bases and supports.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary
Conditions and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.5 - Refrigeration Piping.
   3. ASME B31.9 - Building Services Piping.

B. ASTM International:
      and Materials.
      Fire Stops.
   3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe
      Hangers.

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
      By Factory Mutual Research For Property Conservation.
E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.04 PERFORMANCE REQUIREMENTS

A. Contractor shall design supports for multiple pipes and/or ducts, including pipe and duct stands, capable of supporting combined weight of supported systems, system contents, and fluid.

B. Contractor shall design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.05 SUBMITTALS

A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

B. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Welding certificates.

E. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.

1.06 QUALITY ASSURANCE


B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. B-Line Systems, Inc.
   2. National Pipe Hanger Corporation
   3. Empire Industries, Inc.
   4. Globe Pipe Hanger Products Inc.
   5. Michigan Hanger Co.
   6. PHD Manufacturing, Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.
2.02 DUCT HANGERS AND SUPPORTS

A. Shall be in accordance with SMACNA’s 2005 "HVAC Duct Construction Standards - Metal and Flexible" except non-engineered wire hangers are not permitted. Engineered cable support systems may be used if they meet SMACNA, Ductmate or approved equal.

B. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

C. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

D. Strap and Rod Sizes: Comply with SMACNA’s 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct.

E. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

F. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

G. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

H. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

I. Trapeze and Riser Supports:
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate

2.03 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.04 THERMAL SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield. Insert shall be capable of supporting weight of pipe, insulations and fluid without crushing.

B. Manufacturers:
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.
   3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Manufacturers:
   2. Empire Industries, Inc.
   3. Hilti, Inc.
   4. ITW Ramset/Red Head.
   5. MKT Fastening, LLC.

2.06 MISCELLANEOUS MATERIALS

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

B. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

C. Equipment Supports: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

D. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.

2.07 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. B-Line Systems
   3. Midland Ross Corporation, Electrical Products Division
   4. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 EXECUTION

3.01 PIPE HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in other Division 23 Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system specific sections, install the following types:
   1. MSS Type 1 - Adjustable, Steel Clevis Hangers: For suspension of non-insulated or insulated stationary pipes, 2 inch to 30 inch size.
   2. MSS Type 2 - Yoke-Type Pipe Clamps: For suspension of 120 to 450 deg F pipes, 4 inch to 16 inch size, requiring up to 4 inches of insulation.
   3. MSS Type 3 - Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps: For suspension of pipes, 3/4 inch to 24 inch size, requiring clamp flexibility and up to 4 inches of insulation.
   4. MSS Type 4 - Steel Pipe Clamps: For suspension of cold and hot pipes, 1/2 inch to 24 inch size, if little or no insulation is required.
   5. MSS Type 5 - Pipe Hangers: For suspension of pipes, 1/2 inch to 4 inch size, to allow off-center closure for hanger installation before pipe erection.
   6. MSS Type 12 - Extension Hinged or 2-Bolt Split Pipe Clamps: For suspension of non-insulated stationary pipes, 3/8 inch to 3 inch size.
   7. MSS Type 24 - U-Bolts: For support of heavy pipes, 1/2 inch to 30 inch.
8. MSS Type 26 - Clips: For support of insulated pipes not subject to expansion or contraction.
9. MSS Type 36 - Pipe Saddle Supports: For support of pipes, 4 inch to 36 inch size, with steel pipe base stanchion support and cast-iron floor flange.
10. MSS Type 37 - Pipe Stanchion Saddles: For support of pipes, 4 inch to 36 inch size, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
11. MSS Type 38 - Adjustable, Pipe Saddle Supports: For stanchion-type support for pipes, 2-1/2 inch to 36 inch size, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
12. MSS Type 41 - Single Pipe Rolls: For suspension of pipes, 1 inch to 30 inch size, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
13. MSS Type 43 - Adjustable Roller Hangers: For suspension of pipes, 2-1/2 inch to 20 inch size, from single rod if horizontal movement caused by expansion and contraction might occur.
14. MSS Type 44 - Complete Pipe Rolls: For support of pipes, 2 inch to 42 inch size, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
15. MSS Type 45 - Pipe Roll and Plate Units: For support of pipes, 2 inch to 24 inch, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
16. MSS Type 46 - Adjustable Pipe Roll and Base Units: For support of pipes, 2 inch to 30 inch size, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 8 - Extension Pipe or Riser Clamps: For support of pipe risers, 3/4 inch to 20 inch size.
2. MSS Type 42 - Carbon- or Alloy-Steel Riser Clamps: For support of pipe risers, 3/4 inch to 20 inch size, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 13 - Steel Turnbuckles: For adjustment up to 6 inches for heavy loads.
2. MSS Type 14 - Steel Clevises: For 120 to 450 deg F piping installations.
3. MSS Type 15 - Swivel Turnbuckles: For use with MSS Type 11, split pipe rings.
4. MSS Type 16 - Malleable-Iron Sockets: For attaching hanger rods to various types of building attachments.
5. MSS Type 17 - Steel Weldless Eye Nuts: For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 18 - Steel or Malleable Concrete Inserts: For upper attachment to suspend pipe hangers from concrete ceiling.
2. MSS Type 19 - Top-Beam C-Clamps: For use under roof installations with bar joist construction to attach to top flange of structural shape.
3. MSS Type 20 - Side-Beam or Channel Clamps: For attaching to bottom flange of beams, channels, or angles.
4. MSS Type 21 - Center-Beam Clamps: For attaching to center of bottom flange of beams.
5. MSS Type 22 - Welded Beam Attachments: For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. MSS Type 23 - C-Clamps: For structural shapes.
7. MSS Type 25 - Top-Beam Clamps: For top of beams if hanger rod is required tangent to flange edge.
8. MSS Type 27 - Side-Beam Clamps: For bottom of steel I-beams.
9. MSS Type 28 - Steel-Beam Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads.
10. MSS Type 29 - Linked-Steel Clamps with Eye Nuts: For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. MSS Type 30 - Malleable Beam Clamps with Extension Pieces: For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. MSS Type 34 - Side-Beam Brackets: For sides of steel or wooden beams.
14. MSS Type 57 - Plate Lugs: For attaching to steel beams if flexibility at beam is required.
15. MSS Type 58 - Horizontal Travelers: For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 39 - Steel Pipe-Covering Protection Saddles: To fill interior voids with insulation that matches adjoining insulation.
2. MSS Type 40 - Protection Shields: Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. MSS Type 47 - Restraint-Control Devices: Where indicated to control piping movement.
2. MSS Type 48 - Spring Cushions: For light loads if vertical movement does not exceed 1-1/4 inches.
3. MSS Type 49 - Spring-Cushion Roll Hangers: For equipping Type 41 roll hanger with springs.
4. MSS Type 50 - Spring Sway Braces: To retard sway, shock, vibration, or thermal expansion in piping systems.
5. MSS Type 51 - Variable-Spring Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. MSS Type 52 - Variable-Spring Base Supports: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. MSS Type 53 - Variable-Spring Trapeze Hangers: Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.02 PIPE HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System for Multiple Hangers: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer’s written instructions.

F. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
   3. Floor Support: concrete pier or steel support.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

N. Design hangers for pipe movement without disengagement of supported pipe.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 Provide supplemental angles, channels and formed steel supports to support piping, ductwork, equipment, etc. from building’s structure. Piping, ductwork, equipment, etc. shall not be supported from the roof deck.

3.03 DUCT HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 05 29 - 11
PROJECT No. 056-0052 A / 01/07/2022
C. **Hanger Spacing:** Comply with SMACNA's 2005 "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. **Hangers Exposed to View:** Threaded rod and angle or channel supports.

### 3.04 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports to suspend equipment from structure overhead or to support equipment above floor. Fabricate supports from welded-structural steel shapes. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 21 05 48.

### 3.05 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. **Field Welding:** Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.06 ADJUSTING

A. **Hanger Adjustments:** Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.
### A. Copper and Steel Pipe Hanger Spacing:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>COPPER TUBING MAXIMUM HANGER SPACING Feet</th>
<th>STEEL PIPE MAXIMUM HANGER SPACING Feet</th>
<th>COPPER TUBING HANGER ROD DIAMETER Inches</th>
<th>STEEL PIPE HANGER ROD DIAMETER Inches</th>
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### B. Plastic and Ductile Iron Pipe Hanger Spacing:

<table>
<thead>
<tr>
<th>PIPE MATERIAL</th>
<th>MAXIMUM HANGER SPACING Feet</th>
<th>HANGER ROD DIAMETER Inches</th>
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</thead>
<tbody>
<tr>
<td>ABS (All sizes)</td>
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</tr>
<tr>
<td>FRP (All Sizes)</td>
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<td>3/8</td>
</tr>
<tr>
<td>Ductile Iron (Note 2)</td>
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<tr>
<td>PVC (All Sizes)</td>
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</table>
C. Note 1: Refer to manufacturer’s recommendations for grooved end piping systems.

D. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment support bases.

B. Vibration isolators.

C. Seismic snubber assemblies.

D. Seismic restraints for suspended components and equipment.

E. Roof curbs.

1.02 RELATED REQUIREMENTS

A. Division 01 - General Requirements.

B. Division 03 - Concrete.

C. Section 23 0400 – General Conditions for Mechanical Trades.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)


C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment.

D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment.

E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe.

F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage.

G. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.

H. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

A. See Division 01 - General Requirements
B. Product Data:
1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.
2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.

C. Shop Drawings:
1. Provide schedule of vibration isolator type with location and load on each.
2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.
3. Include auxiliary motor slide bases and rails, base weights, inertia bases, concrete weights, equipment static loads, support points, vibration isolators, and detailed layout of isolator location and orientation with static and dynamic load on each isolator.
4. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
5. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
6. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
7. Include the seal of the Professional Structural Engineer registered where the Project is located, on the drawings and calculations which at a minimum include the following:
   a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
   b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
      1) Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.
      2) Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.
   c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
   d. Detailed description of the equipment anchorage devices on which the certifications are based.
   e. Statement of Special Inspections: Prepared by the registered design professional in responsible charge.
      1) See Division 01 – General requirements.
D. Manufacturer’s Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.05 QUALITY ASSURANCE

A. Perform design and installation in accordance with applicable codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and registered and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
   1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

D. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
   1. See Division 01 – General Requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mason Industries.

B. Novia Associates (Seismic Control Products)

C. Vibration Eliminator Company, Inc.

D. Vibro-Acoustics Ltd

E. Pate

F. Substitutions: See Division 01 - General Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.
   3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
5. All equipment mounted on vibration isolated bases to have minimum operating clearance of 2 inches between the base and floor or support beneath unless noted otherwise.

2.03 EQUIPMENT SUPPORT BASES

A. Structural Bases:
   1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
   2. Frames: Square, rectangular or T-shaped.
   3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

B. Concrete Inertia Bases:
   1. Construction: Engineered, steel forms, with integrated isolator brackets and anchor bolts, welded or tied reinforcing bars running both ways in a single layer.
   2. Size: 6 inches minimum depth and sized to accommodate elbow supports.
   3. Mass: Minimum of 1.5 times weight of isolated equipment.
   4. Connecting Point: Reinforced to connect isolators and snubbers to base including template and fastening devices for equipment.
   5. Concrete: Filled on site with minimum 3000 psi concrete. See Section 03 3000 for additional requirements.
   6. Applications: Adjustable motor slide rails for centrifugal fans.

2.04 VIBRATION ISOLATORS

A. Non-Seismic Type:
   1. All Elastomeric-Fiber Glass Pads:
      a. Configuration: Flat or molded.
      b. Thickness: 0.25 inch minimum.
      c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
   2. Elastomeric Mounts:
      a. Material: Oil, ozone, and oxidant resistant compounds.
      b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
   3. Steel Springs:
      a. Assembly: Freestanding, laterally stable without housing.
      b. Leveling Device: Rigidly connected to equipment or frame.
   4. Restrained Steel Springs:
      a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.

5. Elastomeric Hangers:
   a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
   b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.

6. Spring Hanger:
   a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
   b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

7. Combination Elastomeric-Spring Hanger:
   a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
   b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

8. Thrust Restraints:
   a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
   b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.

B. Seismic Type:
1. Coil Springs Consisting of Single Elements:
   a. Housing Manufactured from cast iron material.
   b. Ductile Material: Designed and rated for seismic applications.
   c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
   d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
   e. Resilient Pad: Located in series with spring.
   f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
   g. Finish: Suitable for the application.

2. All Directional Elastomeric:
   a. Material: Molded from oil, ozone, and oxidant resistant compounds.
   b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.
Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.

d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.

e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

2.05 SEISMIC SNUBBER ASSEMBLIES

A. Comply with:
   2. FEMA 412.
   3. FEMA 413.
   4. FEMA 414.
   5. FEMA E-74.
   6. SMACNA (SRM).

B. All Directional External:
   1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
   2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
   3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
   4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

C. Lateral External:
   1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
   2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
   3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
   4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

D. Omni Directional External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.

2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.

3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.

4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

E. Horizontal Single Axis External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.

2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.

3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.

4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

2.06 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Comply with:
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.
6. SMACNA (SRM).

B. Cable Restraints:
1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.


3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.

4. Connections:
   a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
   b. Internally brace clevis hanger bracket cross bolt to prevent deformation.

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5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:
   1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
   2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
   3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
   4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
   5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

2.07 ROOF CURBS

A. Vibration Isolation Curbs:
   1. Non-Seismic Curb Rail:
      a. Location: Between existing roof curb and rooftop equipment.
      b. Construction: Aluminum.
      c. Integral vibration isolation to conform to requirements of this section.
      d. Weather exposed components consist of corrosion resistant materials.
   2. Non-Seismic Curb:
      a. Location: Between structure and rooftop equipment.
      b. Construction: Aluminum.
      c. Integral vibration isolation to conform to requirements of this section.
      d. Weather exposed components consist of corrosion resistant materials.
   3. Seismic Curb:
      a. Location: Between structure and rooftop equipment.
      b. Construction: Steel.
      c. Integral vibration isolation to conform to requirements of this section.
      d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
      e. Weather exposed components consist of corrosion resistant materials.

B. Seismic Type Non-Isolated Curb and Fabricated Equipment Piers:
   1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Bases:
   1. Set steel bases for one inch clearance between housekeeping pad and base.
   2. Set concrete inertia bases for 2 inches clearance between housekeeping pad and base.
   3. Adjust equipment level.

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.

F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
   1. Up to 4 Inches Pipe Size: First three points of support.
   2. 5 to 8 Inches Pipe Size: First four points of support.
   3. 10 inches Pipe Size and Over: First six points of support.
   4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.02 INSTALLATION - SEISMIC

A. Comply with:
   2. FEMA 412.
   3. FEMA 413.
   4. FEMA 414.
   5. FEMA E-74.
   6. SMACNA (SRM).

B. Seismic Snubbers:
   1. Provide on all isolated equipment, piping and ductwork.

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2. Provide minimum of four seismic snubbers located close to isolators.
3. Snub equipment designated for post-disaster use to 0.05 inch maximum clearance.
4. Snub all other equipment between 0.15 inch and 0.25 inch clearance.

C. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:
1. Install equipment anchorage items designed to resist seismic design force in any direction.
2. Install vibration and seismic controls designed to include base and isolator requirements.
3. Provide flexible connections between equipment and interconnected piping.
4. Provide isolators and restraints designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational and seismic forces.
5. Where equipment is not designed to be point loaded, provide base capable of transferring gravity and seismic demands from equipment to isolator base plate anchorage.
6. Where concrete floor thickness is less than required for expansion anchor installation, install through bolt in lieu of expansion anchor.
7. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws or other mechanical fasteners, install supplemental framing or blocking to transfer loads to structural elements.

D. Suspended Mechanical Equipment:
1. Provide supports and bracing to resist seismic design force in any direction.
2. Provide flexible connections between equipment and interconnected piping.
3. Brace equipment hung from spring mounts using cable or other bracing that will not transmit vibration to the structure.
4. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

E. Wall mounted Mechanical Equipment:
1. Provide support and bracing to resist seismic design force in any direction.
2. Install backing plates or blocking as required to deliver load to primary wall framing members.
3. Anchoring to gypsum wallboard, plaster or other wall finish that has not been engineered to resist imposed loads is not permitted.

F. Piping:
1. Provide seismic bracing in accordance ASCE 7.
2. Provide supports, braces, and anchors to resist gravity and seismic design forces.
3. Provide flexible connections between floor mounted equipment and suspended piping; between unbraced piping and restrained suspended items; as required for thermal movement; at building separations and seismic joints; and wherever relative differential movements could damage pipe in an earthquake.

4. Brace resiliently supported pipe with cable bracing or alternate means designed to prevent transmission of vibrations and noise to the structure.

5. Brace every run 5.0 feet or more in length with two transverse and one longitudinal bracing locations.

6. Pipes and Connections Constructed of Ductile Materials (copper, ductile iron, steel or aluminum and brazed, welded or screwed connections):
   a. Provide transverse bracing at spacing not more than 40.0 feet on center.
   b. Provide longitudinal bracing at spacing not more than 80.0 feet on center.

7. Pipes and Connections Constructed of Non Ductile Materials (cast iron, no-hub, plastic or non-UL listed grooved coupling pipe):
   a. Provide transverse bracing at spacing not more than 20.0 feet on center.
   b. Provide longitudinal bracing at spacing not more than 40.0 feet on center.

8. Provide lateral restraint for risers at not more than 30 feet on center or as required for horizontal runs, whichever is less.

9. Piping Explicitly Exempt from Seismic Bracing Requirements:
   a. Provide flexible connections between piping and connected equipment, including in-line devices such as VAV boxes and reheat coils.
   b. Install piping consistent with ASCE 7, such that swinging of the pipes will not cause damaging impact with adjacent components, finishes, or structural framing while maintaining clear horizontal distance of 67 percent of the hanger length between subject components.
   c. Provide swing restraints as required to control potential impact due to limited space between subject components.

10. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an accredited inspection body is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

11. Re-use of Existing Hangers:
   a. Re-using existing hangers at locations of seismic bracing are to be judged on a case-by-case basis by the registered project design professional.
   b. Unless otherwise shown on the drawings, it is assumed all hangers supporting new piping, located at a seismic brace, will be new.

G. Ductwork:
1. Provide seismic bracing for ducts with cross sectional area greater than 6 sq ft (independent of duct contents).
2. Provide seismic bracing for all ducts containing hazardous materials.
3. Provide supports, braces, and anchors to resist gravity and seismic design forces.
4. Install ducts and duct risers designed to accommodate interstory drift.
5. Independently support in-line devices weighing more than 20 pounds.
6. Independently support and brace all in-line devices weighing more than 75 pounds.
7. Provide unbraced piping attached to braced in-line equipment with adequate flexibility to accommodate differential displacements.
8. Positively attach dampers, louvers, diffusers and similar appurtenances to ductwork with mechanical fasteners.
9. Install duct supports designed to resist not less than 150 percent of the duct weight.
10. The use of power driven fasteners is prohibited in the hanging of ducts weighing over 10 pounds per lineal foot for seismic design categories D, E, and F.
11. Use of proprietary restraint systems with a certificate of compliance, verified and listed by an IAS AC172 accredited inspection body or otherwise accepted by applicable codes is acceptable (pending shop drawing approval), as an alternative to project specific seismic bracing design.

H. Tanks:
1. Install tank anchorage, tank legs and/or supporting structure designed to resist design force.
2. Provide flexible connections between tank and interconnected piping.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Inspect isolated equipment after installation and submit report. Include static deflections.
C. Perform testing and inspections of the installation in accordance with Section 01 4533.

3.04 SCHEDULE

A. Pipe Isolation Schedule.
1. 1 Inch Pipe Size: Isolate 120 diameters from equipment.
2. 2 Inch Pipe Size: Isolate 90 diameters from equipment.
3. 3 Inch Pipe Size: Isolate 80 diameters from equipment.
4. 4 Inch Pipe Size: Isolate 75 diameters from equipment.
5. 6 Inch Pipe Size: Isolate 60 diameters from equipment.
6. 8 Inch Pipe Size: Isolate 60 diameters from equipment.
7. 10 Inch Pipe Size: Isolate 54 diameters from equipment.
8. 12 Inch Pipe Size: Isolate 50 diameters from equipment.
9. 16 Inch Pipe Size: Isolate 45 diameters from equipment.
10. 124 Inch Pipe Size: Isolate 38 diameters from equipment.
11. Over 24 Inch Pipe Size: As indicated.

B. Equipment Isolation Schedule.

1. HVAC Pumps.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

2. Direct Fired Air Units.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

3. Fuel Fired Unit Heaters.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Type: _______________.
   e. Isolator Deflection: _____ inches.

4. Modular Water Chillers.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

5. Air Cooled Condensing Units.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

7. Rotary-Screw Water Chillers.
   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: _____ inches.

   b. Base Thickness: _____ inches.
   c. Isolator Type: Open spring isolators.
d. Isolator Deflection: ______ inches.

10. Induced Draft Cooling Tower.
   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

12. Liquid Coolers.
   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

14. Packaged Roof Top Air Conditioning Units.
   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

15. Computer Room Air Conditioning Units.
   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

16. Pneumatic Controls Compressor.
   b. Base Thickness: ______ inches.
   c. Isolator Type: Open spring isolators.
   d. Isolator Deflection: ______ inches.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Duct Markers.
D. Pipe markers.
E. Warning Signs and Labels
F. Warning Tags
G. Radon Labels
H. Ceiling Tacks

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Division 09- Finishes.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)


1.04 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C. Product Data: Provide manufacturers catalog literature for each product required.
D. Manufacturer’s Installation Instructions: Indicate special procedures, and installation.
E. Project Record Documents:

1. Valve Schedules: For each piping system. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

2. Equipment Schedules: For each item of equipment to be labeled. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 2 PRODUCTS

2.01 EQUIPMENT NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC
2. Brimar Industries, Inc; Kolbi Pipe Marker Co.
3. Seton Identification Products

B. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Adhesive: Contact-type permanent adhesive, compatible with label and substrate.

C. Plastic Labels for Equipment:

1. Material and Thickness: Conform to ASTM D709. Multilayer, multicolor, plastic labels for mechanical engraving, minimum 1/16 inch thick, and having predrilled holes for attachment hardware.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and substrate.

D. Label Content: Include equipment's Drawing designation or unique equipment number.

2.02 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving
   2. Brady Corporation
   3. Brimar Industries, Inc
   4. Kolbi Pipe Marker Co
   5. Seton Identification Products, a Tricor Company
   6. Substitutions: See Division 01-General Requirements.

B. Metal Tags: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware. Brass wire-link, beaded chain or S-hook fasteners. Minimum 1-1/2 inch diameter with smooth edges.

2.03 DUCT MARKERS

A. Manufacturers:
   1. Brimar Industries, Inc
   2. Kolbi Pipe Marker Co
   3. Seton Identification Products

B. General Requirements for Manufactured Duct Labels: Preprinted self-adhesive, premium grade vinyl, color-coded, with lettering indicating service, and showing flow direction.

C. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch printed with UV and chemical resistant inks.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

F. Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to
2.04 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation
   2. Brimar Industries, Inc
   3. Kolbi Pipe Marker Co
   4. MIFAB, Inc
   5. Seton Identification Products

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: Prepared with letter sizes according to ASME A13.1, at least 1-1/2 inches high.

2.05 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.


C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.06 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

2.07 RADON LABELS

A. Radon pipe discharge shall be provided with labeling similar to the following:
1. Caution, radon discharged fumes do not breathe fumes.

B. Radon fan and associated equipment shall be provided with labeling similar to the following:
1. Caution, this is a component of radon reduction system, do not alter or disconnect.

C. Radon fan power and electrical devices shall be provided with labeling similar to the following:
1. Caution, radon fan circuit do not turn off.

D. Radon fan switch shall be provided with labeling similar to the following:
1. Caution, radon fan switch, leave on.

E. Radon reduction system labels shall be provided with labeling similar to the following:
1. Labeling with information for:
   a. Installed By:
   b. Phone number:
c. Installation Date:
d. License / Certificate #:
e. Initial Vacuum pressure:
f. Note: It is advised that this building be tested for radon at least every two years as required or recommend by state and local agencies.

2.08 CEILING TACKS

A. Manufacturers:
   1. Brimar
   2. Craftmark

B. Seton Identification ProductsDescription: Steel with 3/4 inch diameter color coded head.

C. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment, including all scheduled equipment on the drawings, air terminal units, automatic control devices, control panels, instruments, relays and major control components.

B. Locate equipment labels where accessible and readable from the floor.

C. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

3.03 VALVE TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application:

2. Valve-Tag Color: Natural

3. Letter Color: Black

3.04 PIPE LABEL INSTALLATION

A. Install plastic pipe markers in accordance with manufacturer’s instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Pipe Label Color Schedule:

1. Potable, Cooling, Heating and Other Water Piping:
   a. Background Color: Green.

2. Combustible Fluid Piping:

3. Flammable & Oxidizing Fluid Piping:
a. Background Color: Yellow.
b. Letter Color: Black.

4. Toxic & Corrosive Piping:
   a. Background Color: Orange.
   b. Letter Color: Black.

F. Identify valves in main and branch piping with tags.

3.05 DUCT LABEL INSTALLATION

A. Install duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.06 CEILING TACK INSTALLATION

A. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.07 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.
B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.
C. Measurement of final operating condition of HVAC systems.
D. Sound measurement of equipment operating conditions.
E. Vibration measurement of equipment operating conditions.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AABC (NSTSB) - AABC National Standards for Total System Balance
C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems;
D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing;

1.04 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to Architect.
   2. Submit to the Commissioning Authority.
   3. Submit to Engineer of Record.
   4. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   5. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the
Architect and other installers to sufficiently understand the design intent for each system.

6. Include at least the following in the plan:
   a. Preface: An explanation of the intended use of the control system.
   b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
   c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
   d. Identification and types of measurement instruments to be used and their most recent calibration date.
   e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
   f. Final test report forms to be used.
   g. Detailed step-by-step procedures for TAB work for each system and issue, including:
      1) Terminal flow calibration (for each terminal type).
      2) Diffuser proportioning.
      3) Branch/submain proportioning.
      4) Total flow calculations.
      5) Rechecking.
      6) Diversity issues.
   h. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
   i. Details of how TOTAL flow will be determined; for example:
      1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
      2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
   j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
   k. Confirmation of understanding of the outside air ventilation criteria under all conditions.
   l. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
   m. Method of checking building static and exhaust fan and/or relief damper capacity.
   n. Methods for making coil or other system plant capacity measurements, if specified.
   o. Time schedule for TAB work to be done in phases (by floor, etc.).
   p. Description of TAB work for areas to be built out later, if any.
   q. Time schedule for deferred or seasonal TAB work, if specified.
   r. False loading of systems to complete TAB work, if specified.
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GRANBY, CT

s. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
t. Interstitial cavity differential pressure measurements and calculations, if specified.
u. Differential pressure measurements and calculations between the building and its exterior.
v. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
w. Procedures for formal progress reports, including scope and frequency.
x. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit under provisions of Division 01 – General Conditions.
2. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
3. Revise TAB plan to reflect actual procedures and submit as part of final report.
4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and Engineer of Record and for inclusion in operating and maintenance manuals.
5. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
6. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
7. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
8. Units of Measure: Report data in both I-P (inch-pound) units.
9. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   4. SMACNA (TAB) Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      b. NEBB, National Environmental Balancing Bureau
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
  12. Hydronic systems are flushed, filled, and vented.
  13. Pumps and fans are rotating correctly.
  14. Proper strainer baskets are clean and in place.
  15. Service and balance valves are open.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers and control providers whose work will be tested, adjusted, or balanced.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.
C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately two seasons after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Work with Control vendor to establish minimum setpoints necessary to satisfy contract documents. Iterative testing to determine these minimum setpoints will be expected to be in the submittals.

B. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

F. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.07 WATER SYSTEM PROCEDURE

A. Work with Control vendor to establish minimum setpoints necessary to satisfy contract documents. Iterative testing to determine these minimum setpoints will be expected in the submittals.

B. Adjust water systems to provide required or design quantities.

C. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

D. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

E. Effect system balance with automatic control valves fully open to heat transfer elements.

F. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

G. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Division 01 General Requirements for additional requirements.

3.09 SCOPE

A. Test, adjust, and balance the following:

1. Plumbing Pumps.
2. Steam Condensate Pumps.
3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.
9. VFD Setpoints.
10. ECM Setpoints.

B. V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Combustion Equipment:
1. Boiler manufacturer.
2. Model number.
3. Serial number.
4. Firing rate.
5. Overfire draft.
6. Gas meter timing dial size.
7. Gas meter time per revolution.
8. Gas pressure at meter outlet.
13. Percent carbon dioxide (CO2).
14. Percent oxygen (O2).
15. Percent excess air.
16. Flue gas temperature at outlet.
17. Ambient temperature.
18. Net stack temperature.
20. Percent combustion efficiency.

E. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

F. Chillers:
1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.
10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

G. Cooling Tower:
1. Tower identification/number.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Rated capacity.
6. Entering air WB temperature, specified and actual.
7. Leaving air WB temperature, specified and actual.
8. Ambient air DB temperature.
9. Condenser water entering temperature.
10. Condenser water leaving temperature.
11. Condenser water flow rate.
12. Fan RPM.

H. Heat Exchangers:
1. Identification/number.
2. Location.
4. Manufacturer.
5. Model number.
7. Steam pressure, design and actual.
8. Primary water entering temperature, design and actual.
9. Primary water leaving temperature, design and actual.
10. Primary water flow, design and actual.
11. Primary water pressure drop, design and actual.
12. Secondary water leaving temperature, design and actual.
13. Secondary water flow, design and actual.
14. Secondary water pressure drop, design and actual.

I. Cooling Coils:
1. Identification/number.
2. Location.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

J. Heating Coils:
1. Identification/number.
2. Location.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

K. Electric Duct Heaters:
1. Manufacturer.
2. Identification/number.
3. Location.
4. Model number.
5. Design kW.
6. Number of stages.
7. Phase, voltage, amperage.
8. Test voltage (each phase).
10. Air flow, specified and actual.
11. Temperature rise, specified and actual.

L. Induction Units:
1. Manufacturer.
2. Identification/number.
3. Location.
4. Model number.
5. Size.
6. Design air flow.
7. Design nozzle pressure drop.
8. Final nozzle pressure drop.
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<thead>
<tr>
<th></th>
<th>M. Air Moving Equipment:</th>
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<tbody>
<tr>
<td>1.</td>
<td>Location.</td>
</tr>
<tr>
<td>2.</td>
<td>Manufacturer.</td>
</tr>
<tr>
<td>3.</td>
<td>Model number.</td>
</tr>
<tr>
<td>4.</td>
<td>Serial number.</td>
</tr>
<tr>
<td>5.</td>
<td>Arrangement/Class/Discharge.</td>
</tr>
<tr>
<td>6.</td>
<td>Air flow, specified and actual.</td>
</tr>
<tr>
<td>7.</td>
<td>Return air flow, specified and actual.</td>
</tr>
<tr>
<td>8.</td>
<td>Outside air flow, specified and actual.</td>
</tr>
<tr>
<td>9.</td>
<td>Total static pressure (total external), specified and actual.</td>
</tr>
<tr>
<td>10.</td>
<td>Inlet pressure.</td>
</tr>
<tr>
<td>11.</td>
<td>Discharge pressure.</td>
</tr>
<tr>
<td>13.</td>
<td>Number of Belts/Make/Size.</td>
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<td>14.</td>
<td>Fan RPM.</td>
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<tr>
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<th>N. Return Air/Outside Air:</th>
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<tbody>
<tr>
<td>1.</td>
<td>Identification/location.</td>
</tr>
<tr>
<td>2.</td>
<td>Design air flow.</td>
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<tr>
<td>3.</td>
<td>Actual air flow.</td>
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<tr>
<td>4.</td>
<td>Design return air flow.</td>
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<tr>
<td>5.</td>
<td>Actual return air flow.</td>
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<tr>
<td>6.</td>
<td>Design outside air flow.</td>
</tr>
<tr>
<td>7.</td>
<td>Actual outside air flow.</td>
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<tr>
<td>8.</td>
<td>Return air temperature.</td>
</tr>
<tr>
<td>10.</td>
<td>Required mixed air temperature.</td>
</tr>
<tr>
<td>11.</td>
<td>Actual mixed air temperature.</td>
</tr>
<tr>
<td>12.</td>
<td>Design outside/return air ratio.</td>
</tr>
<tr>
<td>13.</td>
<td>Actual outside/return air ratio.</td>
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</tbody>
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<tr>
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<th>O. Exhaust Fans:</th>
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<tbody>
<tr>
<td>1.</td>
<td>Location.</td>
</tr>
<tr>
<td>2.</td>
<td>Manufacturer.</td>
</tr>
<tr>
<td>3.</td>
<td>Model number.</td>
</tr>
<tr>
<td>4.</td>
<td>Serial number.</td>
</tr>
<tr>
<td>5.</td>
<td>Air flow, specified and actual.</td>
</tr>
<tr>
<td>6.</td>
<td>Total static pressure (total external), specified and actual.</td>
</tr>
<tr>
<td>7.</td>
<td>Inlet pressure.</td>
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<tr>
<td>8.</td>
<td>Discharge pressure.</td>
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<tr>
<td>10.</td>
<td>Number of Belts/Make/Size.</td>
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<tr>
<td>11.</td>
<td>Fan RPM.</td>
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<tr>
<th></th>
<th>P. Duct Traverses:</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>System zone/branch.</td>
</tr>
<tr>
<td>2.</td>
<td>Duct size.</td>
</tr>
<tr>
<td>3.</td>
<td>Area.</td>
</tr>
</tbody>
</table>
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

Q. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

R. Air Monitoring Stations:
1. Identification/location.
2. System.
3. Size.
4. Area.
5. Design velocity.
6. Design air flow.
7. Test velocity.
8. Test air flow.

S. Flow Measuring Stations:
1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.
5. Model number.
7. Design Flow rate.
8. Design pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

T. Terminal Unit Data:
1. Manufacturer.

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2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

U. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. HVAC piping insulation, jackets and accessories.
   1. HVAC ductwork insulation, jackets, and accessories.

B. Related Sections:
   1. Division 01 – General Requirements
   2. Division 07 – Firestopping
   3. Division 09 – Finishes
   4. Section 23 0553 – Identification of HVAC Piping and Equipment
   5. Section 23 3100 – HVAC Ducts and Casings
   6. Section 23 2113 – Hydronic Piping

1.02 REFERENCES

A. ASTM International:
      Sheet and Plate.
      Cement.
   3. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-
      Setting Thermal Insulating and Finishing Cement.
   4. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting
      Covers for NPS Piping, and Vessel Lagging.
   5. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe
      Thermal Insulation.
   6. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric
      Cellular Thermal Insulation in Sheet and Tubular Form.
      Insulation for Commercial and Industrial Applications.
      Insulation.
  10. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid
      Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
      Polyisocyanurate Thermal Insulation.
  12. ASTM C612 - Standard Specification for Mineral Fiber Block and Board
      Thermal Insulation.
  13. ASTM C795 - Standard Specification for Thermal Insulation for Use in
      Contact with Austenitic Stainless Steel.

B. Sheet Metal and Air Conditioning Contractors’:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. Underwriters Laboratories Inc.:

1.03 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer’s Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

D. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.
E. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

F. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.05 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements:

B. Convene minimum one week prior to commencing work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping. Store all insulation materials in a clean, dry environment.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 WARRANTY

A. Division 01 - Execution and Closeout Requirements.

1.10 SCHEDULING

A. Schedule insulation application after pressure and leak testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

2.02 MANUFACTURER

A. Manufacturers for Flexible Glass Fiber (FGF), Pre-Molded Glass Fiber (PGF) and Rigid Glass Fiber (RGF) Insulation Products:
   1. Knauf Insulation
   2. Johns Manville Corporation
   3. Owens-Corning.
   4. Substitutions: Division 01.

B. Manufacturers for Closed Cell Elastomeric (CCE) Insulation Products:
   1. Aeroflex. USA, Inc.
   2. Armacell, LLC (Interior- ArmaFlex, Exterior- ArmaTuff)
   3. K-Flex USA LLC
   4. Substitutions: Division 01.

C. Manufacturers for Polyisocyanurate Foam Insulation Products: (steam only)
   1. Dow Chemical Company.
   2. Owens-Corning
   3. Johns Manville Corporation
   4. Substitutions: Division 01.

D. Manufacturers for Fire Rated (FR) Insulation Products:
   1. 3M Fire Barrier Duct Wrap 615+.
   2. Morgan Theramal Ceramics Pyroscat DuctWrap XL
   3. Unifrax FyreWrap Elite 1.5
   4. Substitutions: Division 01.

E. Manufacturers for Jacketing (PVC):
   1. Johns Manville
   2. P.I.C. Plastics Inc.
   3. Proto Corporation
   4. Substitutions: Division 01.

F. Manufacturers for Jacketing (ALM):
   1. Childers Brand
2. ITW Insulation Systems
3. RPR Products
4. Substitutions: Division 01.

G. Manufacturers for exterior pipe/duct waterproof jacketing (WJ):
1. Polyguard Products, Inc.; Alumaguard 60.
2. Venture Tape Corporation; VentureClad Plus.
3. MFM Building Products Corp: Flex Clad 400
4. Substitutions: Division 01.

2.03 PIPE INSULATION

A. Pre-Molded Glass Fiber (PGF) Insulation:
   1. ASTM C547 and ASTM C795, rigid molded, noncombustible.
   2. 'K' ('Ksi') Value: ASTM C177, 0.24 at 75°F.
   3. Maximum Service Temperature: 850°F.
   4. Maximum Moisture Absorption: 0.2 percent by volume.
   5. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; self-sealing lap, moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (ASJ-SSL).

B. Closed Cell Elastomeric (CCE) Insulation:
   1. Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   2. Minimum Service Temperature: Minus 40°F.
   3. Maximum Service Temperature: 220°F.

2.04 PIPE INSULATION JACKETS

   1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
   2. Thickness: 10 mil.

B. Aluminum (ALM): Self-Adhesive Waterproofing Jacket. Minimum 12 mil thick, vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; UV resistant, zero permeability with textured aluminum-foil facing, impact and tear resistant.

2.05 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.
C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: hydrous calcium silicate. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.


F. Valve insulation Wraps: White, noncombustible, conforming to ASTM E 84. Match insulation thickness to pipe size. Valve covers shall be easily removable.

2.06 DUCTWORK INSULATION

A. Flexible Glass Fiber (FGF) Insulation: ASTM C553 Type I, II, or III, ASTM C1290 Type III, in accordance to NFPA 90A and NFPA 90B for duct coverings, with ASTM C1136 foil scrim kraft (FSK).
   1. Thermal performance: 1.0 lb/ft$^3$, 7.4 ft$^2$ hr °F/btu minimum R-value for 2” thick at 75°F mean temperature per ASTM C177 and ASTM C518.
   2. Operating temperature range: 40°F to 250°F.
   3. Water vapor permeance: 0.02 perms maximum per ASTM E96.
   4. Water vapor sorption: 5% by weight maximum per ASTM C1104.

B. Rigid Glass Fiber (RGF) Insulation: Glass fiber board, ASTM C 612 Type 1A or 1B, in accordance to NFPA 90A and NFPA 90B for duct coverings, with ASTM C 1136 foil scrim kraft (FSK).
   1. Thermal performance: 8.7 ft$^2$ hr °F/btu minimum R-value for 2” thick at 75°F mean temperature per ASTM C177 and ASTM C518.
   2. Operating temperature range: 0°F to 450°F.
   3. Water vapor permeance: 0.02 perms maximum per ASTM E96.
   4. Water vapor sorption: 5% by weight maximum per ASTM C1104.

C. Closed Cell Elastomeric (CCE) Insulation:
   1. Thermal performance: 8.0 ft$^2$ hr °F/btu minimum R-value for 2” thick at 75°F mean temperature per ASTM C177 and ASTM C518.
   2. Operating temperature range: -40°F to 220°F.
   3. Water absorption: 0.2% by volume per ASTM C 209 or ASTM C1763.
   4. Water vapor permeability: 0.08 perm-in per ASTM E 96.
   5. Ultraviolet (UV) resistance: Excellent per ASTM G 53 or ASTM G 90.
   6. Weatherability: Excellent per ASTM D 471.

D. Fire Rated (FR) Insulation:
   1. Inorganic blanket encapsulated with scrim reinforced foil meeting UL 1978
2. Thermal Conductivity: 0.42 at 500°F.
3. Weight: 1.4 pound per square foot.
4. Surface Burning Characteristics: Maximum 0/0 flame spread/smoke developed index when tested in accordance with ASTM E84.

E. Technical Data:
1. Insulation shall pass when tested in accordance with the following:
   b. Fire resistance (wall) per ASTM E119.
   c. Durability test per ASTM C518.
   d. Internal fire test per ASTM E2336.
   e. Fire engulfment (duct) per ASTM E814.
   f. ULC grease duct test protocol.
   g. Grease duct clearances per UL1978.
   h. Air duct ventilation enclosure per ISO6944.
2. Thermal performance: 6.3 ft² hr °F/btu minimum R-value for 1-1/2” thick at 75°F mean temperature per ASTM C177 and ASTM C518.

2.07 DUCTWORK JACKETS

A. Aluminum (ALM): Self-Adhesive Waterproofing Jacket: Minimum 12 mil thick, vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; UV resistant, zero permeability with textured aluminum-foil facing, impact and tear resistant.

2.08 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

I. Membrane Adhesives: As recommended by membrane manufacturer.
PART 3 EXECUTION

3.01 EXAMINATION

A. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify piping, equipment and ductwork surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION - PIPING SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Piping Exposed to View in Finished Spaces Provide with PVC Plastic pipe jacketing for additional protection. Locate insulation and cover seams in least visible locations.

D. Piping Exposed to view in mechanical spaces. Provide with PVC Plastic pipe jacketing for additional protection. Locate insulation and cover seams in least visible locations.

E. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 for penetrations of assemblies with fire resistance rating greater than one hour.

F. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

G. For all hot piping conveying fluids, insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature.
1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Insulation Terminating Points:
1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

K. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer’s recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
O. Install valve bags on all chilled water valves unless otherwise indicated. Valve bags shall be easily removable for servicing of valves.

P. Prepare pipe insulation for finish painting. Refer to Division 09.

3.03 INSTALLATION - DUCTWORK SYSTEMS

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Protect insulation from exposure to moisture prior to and after installation. All insulation other than flexible elastomeric that becomes wet shall be replaced at no cost to the project.

D. Duct dimensions indicated on Drawings are finished inside dimensions.

E. Insulated ductwork conveying air below ambient temperature:
   1. Provide insulation with vapor retarder jackets.
   2. Finish with tape and vapor retarder jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

F. Insulated ductwork conveying air above ambient temperature:
   1. Provide with or without standard vapor retarder jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

G. External Elastomeric Duct Insulation:
   1. Adhere to clean oil-free surfaces with full coverage of adhesive.
   2. Seal seams and butt joints with manufacturer’s recommended adhesive.
   3. When application requires multiple layers, apply with joints staggered.
   4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
   5. Lift ductwork off trapeze hangers and insert spacers.

H. Kitchen Exhaust Ductwork:
   1. Cover duct by wrapping with insulation using overlap method and butt joint with collar method.
   2. Overlap seams of each method by 3 inches.
   3. Attach insulation using steel banding or by welded pins and clips.
   4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.

I. Ducts Exterior to Building:
   1. Install insulation according to external duct insulation paragraph above.
2. Provide external insulation with vapor retarder jacket. Cover with outdoor jacket finished with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
3. Finish with aluminum duct jacket.
4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.

J. Duct Acoustical Liner
1. Ductwork shall still be insulated per this specification even if the ductwork is acoustically lined. Acoustically lined ductwork does not negate the use of wrap as insulation.

K. Prepare duct insulation for finish painting. Refer to Division 09.

3.04 SCHEDULES

3.05 DUCTWORK SCHEDULES

A. Items Not Insulated:
   1. Fibrous-glass ducts.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   5. Factory-insulated access panels and doors.

B. Provide insulation materials and thicknesses identified below. If more than one material is listed for a duct location, selection from materials listed is Division 23 option.

<table>
<thead>
<tr>
<th>Heating and Cooling Supply, Return, and Outside Air Ducts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>Exterior to building envelope</td>
</tr>
<tr>
<td>Concealed within thermal envelope of building</td>
</tr>
</tbody>
</table>
### Dishwasher Exhaust Ducts

<table>
<thead>
<tr>
<th>Description</th>
<th>Minimum As-Installed R-Value</th>
<th>Insulation Type</th>
<th>Minimum Thickness (inches)</th>
<th>Jacketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concealed in unconditioned spaces including shafts, mechanical spaces, non-plenum return ceiling cavities and crawlspaces (ventilated and non-ventilated)</td>
<td>R-3.5</td>
<td>Flexible Glass Fiber (FGF)</td>
<td>1.5</td>
<td>FSK</td>
</tr>
</tbody>
</table>

### Concealed, Type I (Grease), Commercial, Kitchen Hood Exhaust Duct and Plenums

<table>
<thead>
<tr>
<th>Description</th>
<th>Minimum As-Installed R-Value</th>
<th>Insulation Type</th>
<th>Minimum Thickness (inches)</th>
<th>Jacketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concealed within thermal envelope of building.</td>
<td>N/A</td>
<td>Fire Rated (FR)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Exterior to building envelope</td>
<td>R-12.0</td>
<td>Closed Cell Elastomeric (CCE)</td>
<td>3.0</td>
<td>ALM</td>
</tr>
</tbody>
</table>

3.06 **DUCT LINER**

A. See Section 23 3100 - HVAC Ducts and Casings, for duct liner specifications
3.07 PIPE INSULATION SCHEDULE

A. Provide insulation materials and thicknesses scheduled for each system type and pressure/temperature range. If more than one material is listed for a system, selection from materials listed is Division 23 option.

B. For dual temperature systems (heating and cooling), provide thickness equal to greater of heating or cooling scheduled value. Dual temperature piping shall also meet all vapor barrier requirements for cooling insulation (perm rating).

C. Insulation for pre-insulated piping shall meet all specified requirements.

D. Insulate piping operating at temperatures below 40°F and systems operating between 40°F to 65°F in accordance with NAIMA Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation. Comply with all recommendations including but not limited to the requirement for vapor dams every fourth section of insulation.

### Heating Hot Water Systems

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>Pipe Size (inch)</th>
<th>Indoor - Minimum Thickness (inch)</th>
<th>Outdoor - Minimum Thickness (inch)</th>
<th>Factory Applied Jacket</th>
<th>Field Applied Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Molded Glass Fiber (PGF)</td>
<td>Less than 1 to 1.5</td>
<td>1.5</td>
<td>3.0</td>
<td>ASJ-SSL</td>
<td>Indoor: PVC for exposed piping finished space and mechanical rooms. Outdoor: ALM</td>
</tr>
<tr>
<td></td>
<td>1.5 and Larger</td>
<td>2.0</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Refrigerant Piping

<table>
<thead>
<tr>
<th>Insulation Type</th>
<th>Pipe Size (inch)</th>
<th>Indoor - Minimum Thickness (inch)</th>
<th>Outdoor - Minimum Thickness (inch)</th>
<th>Factory Applied Jacket</th>
<th>Field Applied Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed Cell Elastomeric (CCE)</td>
<td>Less than 3</td>
<td>1.0</td>
<td>1.0</td>
<td>N/A</td>
<td>Indoor: N/A Outdoor: ALM</td>
</tr>
</tbody>
</table>
PART 1 GENERAL

1.01 SECTION INCLUDES

A. System Description
B. General Purpose Digital Controllers
C. Unitary Or Terminal Digital Controllers
D. Input/Output Interface
E. Bridges And Routers
F. Gateways
G. Panels
H. Power Supplies And Line Filtering
I. System Software
J. Controller Software
K. Input Hardware
L. Thermostats
M. Control Valves
N. Dampers
O. Actuators
P. Wire, Cable And Network Accessories

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. This Section includes provision of control sequences for HVAC systems, subsystems, and equipment indicated on the drawings and other Division 23 specification sections.
C. Section 23 0400 – General Conditions for Mechanical Trades.

D. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

E. Section 28 3100 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)


B. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks.

C. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; Revision G.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL (DIR) - Online Certifications Directory.

1.04 DEFINITIONS

A. Backbone: The high traffic density connectivity portion of the communication network.

B. Bridge: A device that connects two or more LAN segments at the physical and data link layers. This device may also perform message filtering if programmed to do so.

C. Browser: A computer program that accesses and displays information from the Internet or intranet.

D. Client: A system or device that makes use of another device for some particular purpose through a system request.

E. Device (BACnet): A device, real or virtual, that supports digital communication using the BACnet protocol. Examples would be an operator terminal, router, unitary controller, etc.

F. Ethernet: Ethernet is a widely used Local Area Network (LAN). Ethernet, which conforms to IEEE Standard 802.3.

G. Events: Changes in the state of an object, typically between Normal, Off-Normal, and Fault Condition. Events may be reported to other BACnet devices.

H. Firewall: A security mechanism placed at the connection between networks and/or at networks outside connections. The firewall restricts access to the network.
I. Gateway: A device that connects two or more dissimilar networks by message translation and signal conditioning, permitting information exchange among them. A gateway would be necessary to translate LonWorks messages to the BACnet form.

J. Gbps: Gigabits per second. A unit of data transfer speed equal to 1024 Mbps.

K. GUI: Graphical User Interface, a type of Operator Interface Device for a BAS.

L. Hertz: A unit of measure equal to an oscillation per second.

M. HTML: The source form used for documents on the Internet or on an intranet. HTML embeds commands that determine formatting along with the text to be displayed.

N. Instance: A number which uniquely identifies an object within a device (e.g., Analog Input No.1, No. 2, etc.). Device Objects are required to have an instance number that is unique to their internetwork. Instance numbers may range from 0 to 4194303.

O. ID: Identification (name, number, plate, or tag).

P. IP: Internet Protocol. The protocol that defines both the format of packets used on a TCP/IP internet or intranet and the mechanism for routing a packet to its destination.

Q. IP address: A 32-bit address assigned to a device that uses TCP/IP protocols.

R. Kbps: A unit of data transfer equal to 1024 bits per second.

S. LAN: A LAN is a network of interconnected hardware devices sharing resources within a relatively small geographic area.

T. Mbps: A unit of data transfer equal to 1024 Kbps.

U. MS/TP: The Master-Slave/Token-Passing EIA-485 LAN developed for BACnet by ASHRAE. Operates at 9600, 19.2K, 38.4K and 76.8 K BPS. Master nodes (devices) pass around a speaking token which entitles the holder to initiate BACnet messages. Slave nodes can only respond to messages from Masters.

V. Native BACnet: A Building Automation System that uses the BACnet protocol for its data transfer between hardware devices and operator interface devices.

W. Object Identifier: A 32-bit number which uniquely identifies an object within a device, or the device object internetwork-wide. 10 bits represent the object type and 22 bits the instance number.

X. PC: Personal Computer.
Y. Peer-to-Peer Communication: Communication between equals. In BACnet, application programs (performing the functions of the BACnet devices on which they run) in devices of the appropriate conformance class talk to each other as peers, using the Protocol Stacks to deliver their message to each other. Likewise, Network Layers may talk as peers to determine how to route messages.

Z. Physical Segment: A single continuous medium 9-wire to which BACnet nodes are attached.

AA. PID: Proportional Integral and Derivative.

BB. Protocol: A design that specifies the details of how digital devices interact.

CC. Repeater: A device that connects two or more physical segments of a LAN at the physical layer and exactly reproduces the electrical signals on either side so that nodes on either side of the repeater are considered to be on the same network.

DD. Router: A device which connects two or more networks, of same or different types, so that a BACnet message may be transferred across the appropriate networks to reach its destination.

EE. RS-232-C: The technical name of the standard for serial data connections such as those between a computer and a keyboard.

FF. Server: A computer or hardware device which stores the resources accessed by other computers or hardware devices (clients).

GG. TCP/IP: The protocol suite used in the Internet. Although the suite contains many protocols, TCP and IP are two of the most important.

HH. Unitary Controller: Devices which controls and/or monitors a single piece of equipment.

II. WEB: A synonym for the World Wide Web. In modern usage pertains to both the Internet and to intranets using the TCP/IP Protocol.

1.05 GENERAL REQUIREMENTS

A. All work of this section shall be coordinated and provided by the single Building Management System (BMS) Contractor.

B. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically
mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

C. The BMS shall perform all sequences of operation which may be listed on control drawings. Controls supplier shall provide all devices necessary to completely perform sequences whether such devices are explicitly shown on the drawings specified, or not shown or specified.

D. Where other Sections include a requirement for manufacturer equipment controllers (e.g. chillers, boilers, packaged units that are specified with packaged controls), this Section shall be responsible for provision of control components and software required to perform sequences of operation outlined that are in addition to the capabilities of the controllers provided with the manufacturer equipment. Coordinate and integrate all equipment controllers.

E. Each component of the system, including the LANs and software, shall be in full compliance with ASHRAE Standard 135, commonly referred to as BACnet.

F. Provide the services of control manufacturer’s representative to be on site during startup, testing and balancing procedures, detailed in Part 3 of this specification. Representative shall be part of manufacturer’s service organization and shall be skilled in the adjustment and calibration of all control devices as well as being capable of modifying and checking system software.

1.06 ADMINISTRATIVE REQUIREMENTS

A. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades.

B. If the Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

C. Pre-installation Meeting: Conduct a pre-installation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

D. Scheduling: Coordinate with Owner and General Contractor. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

1.07 COORDINATION

A. Coordinate locations of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate work under provisions of General Conditions and Division 1 as applicable.
C. Coordinate material delivery to comply with project schedule.

D. Coordinate conduit, and wiring installation with other trades to avoid conflicts.

E. Coordinate panel locations and installation with other trades to avoid conflicts and to provide power and other requirements.

1.08 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
   2. Control System Software: Include technical data for operating system software, operator interface, color graphics, information on programmability and other third-party applications.
   3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data.

B. Shop Drawings: Submit shop drawings containing the following information for each control system:
   1. System architecture diagram: Indicate programmable control unit locations, and trunk data conductors.
   2. Schematic control diagrams: Submit diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   3. Floor plans: Show sizes and locations of components, horizontal routing and risers.
   4. Points list: List connected data points, including connected control unit and input device.
   5. Sequence of operation: Written detailed operational description of sequences.
   6. Schedule of dampers: Include size, leakage, pressure drop and other flow characteristics.
   7. Schedule of valves: Including flow, pressure drop, valve coefficient (CV), shut-off head, maximum controllable differential pressure range and other flow characteristics.

C. Wiring Diagrams: Submit wiring diagrams, detailing wiring for power, signal, and control systems and differentiating clearly between manufacturers installed and field installed wiring.
D. Sample Covers: Submit samples of each type of space sensor cover for approval prior to ordering the covers.

E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owners name and registered with manufacturer.

1.09 RECORD DOCUMENTATION

A. General: Manuals shall be furnished as files in portable document format (PDF). One complete set of manuals shall be furnished before the contract is complete. The manuals shall include the name, address and telephone number of each subcontractor installing equipment and systems and of the local representative for each specific item of equipment and each system provided. A logically organized table of contents shall be included with dynamic links to view all data sheets.

B. Hardware Manual: The hardware manual shall describe the system and each piece of equipment provided.

C. Software Manual: The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution.

D. Operations Manual: The Operations manual shall describe the operations of the complete system.

E. Maintenance Manual: The maintenance manual shall provide descriptions of maintenance for each piece of equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

F. Project Drawings: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors. Revise shop drawings to reflect actual installation and operating sequences.

1.10 QUALITY ASSURANCE

A. Products shall be standard manufacturer products having been in commercial or industrial use for at least one year prior to the bid date for this project. Products shall comply with the following as a minimum:

2. NISTIR 6392 for digital system control components.
5. Applicable provisions of NEC.
B. Designer Qualifications: Perform design of system software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and certified and marked for intended use.

F. Comply with ASHRAE 135 for DDC system components.

1.11 PERFORMANCE REQUIREMENTS

A. Accuracy: Report values and maintain measured variables within tolerances as follows:
   1. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
   2. Water Flow: Plus or minus 5 percent of full scale.
   3. Water Pressure: Plus or minus 2 percent of full scale.
   4. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
   5. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
   6. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
   7. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
   8. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
   9. Relative Humidity: Plus or minus 5 percent.
   10. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
   11. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
   12. Airflow (Terminal): Plus or minus 10 percent of full scale.
   13. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
   15. Carbon Monoxide: Plus or minus 5 percent of reading.
   16. Carbon Dioxide: Plus or minus 50 ppm.
   17. Electrical: Plus or minus 5 percent of reading.

B. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

1.12 WARRANTY

A. Correct defective Work within a five year period after Substantial Completion.

B. Provide five year manufacturer’s warranty for field programmable micro-processor based units.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide operator workstation software, controller software, and custom application programming language, building controllers, programmable application controllers and application specific controllers from only one of the following manufacturers.
   1. Distech Controls, by Connecticut Temperature Controls (CTC).
   2. Substitutions or approved equal: Section 01 60 00 – Product Requirements.

B. The system shall be integrated into the current BMS System. The current system is serviced by Connecticut Temperature Controls. All programming and graphics must follow the current site standards and be approved by the owner.

2.02 SYSTEM DESCRIPTION

A. The system shall consist of a series of digital controllers interconnected by the LAN. One or more operator interface devices shall be connected to the LAN to provide access to the controllers for the purpose of receiving information or issuing commands. The controllers shall be located adjacent to the equipment they monitor or control and shall be sized for the task assigned to them. The system shall utilize distributed processing architecture and one controller shall be provided for each major piece of equipment controlled or monitored except that the equipment associated with the chiller plant and the heating plant shall be controlled from multiple controllers if necessary.

B. The communication network between building controllers shall be BACnet over Ethernet or BACnet over IP. The communication network between unitary or terminal unit controllers shall be BACnet MS/TP over EIA-485. BACnet Point-To-Point may be used for communication between the network and modems, line drivers or other data communication equipment.

C. The BAS software shall be designed around the open standards of web technology. The BAS server shall communicate using the ASHRAE BACnet/IP protocol. The Server shall be accessed using a web browser. The web browser Graphical User Interface shall support Microsoft browsers, and Windows as well as non-Windows operating systems. No special software shall be required for the PC’s/PDA’s used to access the BAS via a web browser.

D. Input devices such as temperature sensors, humidity sensors, pressure sensors, motor current sensors, relays and other devices to sense or measure conditions of equipment or space, shall be provided as part of the system to meet the requirements of the sequences of operation.

E. Output devices such as valves, dampers, damper operators, relays, solenoids, transducers, or other devices to control equipment, shall be provided as part of the system to meet the requirements of the sequences of operation.
F. Labeling: Provide a comprehensive labeling system for each wiring and component using the designations shown on the approved submittals.

G. Electrical Work: Provide the BAS power and control wiring required. This shall include power requirements for control panels, field controllers, sensors and other control devices. Provide transformers necessary to step down from the available voltage to the voltage required to operate the control system products and control devices.

H. Other Work: The work included under this Division shall include the drawings, specifications, submittals, equipment, labor, materials, technical supervision, transportation, training services, documentation, warranty, and other appurtenant work as required to furnish and install a fully operational system to monitor and control, set forth, in strict accordance with these specifications and subject to the terms and conditions of the Contract. An apparatus, appliance, material or work not shown on the drawings but mentioned in the specifications, or vice versa, or incidental accessories necessary to make the work entirely complete and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the Contractor without additional expense to the Owner.

I. Completion: It is the intention of the specifications and drawings to call for furnished work, tested, and ready for operation. Wherever the word “provide” is used, it shall mean “provide and install complete and ready for use.”

J. Omissions: Minor details not usually shown or specified but necessary for proper installation and operations shall be included, as if herein specified and/or shown.

2.03 GENERAL PURPOSE DIGITAL CONTROLLERS

A. General Purpose Digital Controllers shall be BTL listed.

B. Communication Speed: Controllers shall communicate using Ethernet or BACnet/IP using an unshielded twisted pair at the Data Link Layer.

C. General Specification: Each General Purpose Digital Controller shall be capable of stand-alone DDC operation utilizing its own minimum 16-bit processor, non-volatile flash memory, input/output, 10-bit A to D conversion, hardware clock/calendar, and voltage transient and lightning protection devices. Firmware revisions to the controller shall be made from the BAS server or remotely over the intranet or Internet. Controllers shall not require component changes to implement firmware revisions.

D. Self-Test Diagnostics: Each controller shall include self-test diagnostics, enabling the controller to automatically report malfunctions to the server.

E. Each General Purpose Multiple Application Digital Controller shall contain both software and firmware to perform full DDC Proportional, Integral, and Derivative (PID) control loops and programs.
F. Input/Output Processing:
1. Digital outputs shall be relays, each configured as normally open or normally closed. Each output shall have a manual Hand-Off-Auto switch to allow for override and a LED to indicate the operating mode of the output.
2. Universal inputs shall be Thermistor, RTD 0-10VDC, 0-20 mA, resistive and dry contact.
3. Analog output shall be electronic, voltage mode 0-10 VDC, current mode 4-20mA.

G. Power and Noise Immunity:
1. Maintain operation at 90 to 110 percent of nominal voltage rating.
2. Perform orderly shutdown below 80 percent of nominal voltage.
3. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

2.04 UNITARY OR TERMINAL DIGITAL CONTROLLERS

A. BACnet BIBBs: The Unitary Controllers shall use BACnet as the native communications protocol between controllers on the unitary controller network and shall be classified as AACs, ASCs, or SAs by the BACnet Testing Laboratory.

B. Communication Speed: The communication between unitary controllers shall be 38.4 Kbps, minimum, over EIA-485, using MS/TP architecture.

C. Sensor Support: Each unitary controller shall be able to support various types of zone temperature sensors, such as temperature sensor only, temperature sensor with built-in local override switch, and temperature sensor with built-in set point adjustment switch.

D. Each Unitary Controller for VAV application shall have a built-in air flow transducer for accurate air flow measurement in order to provide the pressure independent VAV operation, and an integral direct-coupled electronic actuator.

E. Visual Status: Each unitary controller and unitary controller interface shall have LED indication for visual status of communication, power, and each output.

F. Standalone Algorithm: In the event of a loss of communication, each Unitary Controller shall control from a stand-alone algorithm to maintain the assigned space temperature until communication with the unitary control module interface is restored.

G. Input/Output Processing:
1. Digital Outputs shall be relays, 24 Volts AC or DC maximum, having 3-amp maximum current. Each relay shall be configured as normally open or normally closed, and either dry contact or bussed.
2. Universal Inputs shall be Thermistor, RTD, dry contacts or 0-5VDC.
3. Enhanced Zone Sensor Input: The input shall provide one Thermistor input, one local setpoint adjustment, one timed local override switch, and one occupancy LED indicator.

4. Analog Output electronic, voltage made 0-10VDC or current mode 4-20mA or 3-wire floating.

2.05 INPUT/OUTPUT INTERFACE

A. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

B. All Input/Output Points:
   1. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   2. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

C. Binary Inputs:
   1. Allow monitoring of On/Off signals from remote devices.
   2. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   3. Sense dry contact closure with power provided only by the controller.

D. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.

E. Analog Inputs:
   1. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   2. Compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs:
   1. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   2. Outputs provided with three position (On/Off/Auto) override switches.
   3. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

G. Analog Outputs:
   1. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   2. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
H. Tri State Outputs:
1. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
2. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
   a. VAV terminal units.
   b. Duct mounted heating coils.
   c. Zone dampers.
   d. Radiation.
3. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. System Object Capacity:
1. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
2. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.06 BRIDGES AND ROUTERS

A. The controller network shall use BACnet as its native communication protocol. Network bridges and routers must be of a modular design to ensure reliability and system performance. Routers and bridges must be used between system LANs and between the system and third party devices requiring interfaces.

B. BACnet Router: The central system shall use the building’s Local Area Network (LAN) for communication. The communication between the central server and the controllers shall be BACnet/IP. A router shall be provided as required to bridge BACnet/IP and the data link used between controllers (BACnet Ethernet and BACnet MS/TP). Proprietary networks and proprietary protocols are not acceptable. The BACnet routers shall utilize flash memory to allow firmware upgrades to be performed remotely.

C. Unitary Controller Router: A router shall be provided as required to bridge between the unitary controller network and the main controller network.

2.07 GATEWAYS

A. Bi-Directional Protocol Translator (BPT): The Building Automation System shall establish an interconnection, which appears to the operator to be seamless, between the building’s electrical and/or mechanical subsystems, as well as other manufacturers’ control systems as may be installed in the future. These systems shall be controlled, monitored, and programmed with the same programming language used for the other control modules.
1. The BPT shall be a microprocessor-based communication device to provide seamless, two-way translation between two or more standard or non-standard protocols.
2. The BPT shall be available for a variety of Data Link/Physical Layer configurations, including PTP (point-to-point) via EIA-232, MS/TP via EIA-485, and ARCNET.

3. In addition to BACnet, the BPT shall also support other protocols including Modbus, JBus and other protocols as specified herein for electrical/mechanical subsystems.

4. The BPT shall have at least three communications ports: One shall be for communication between native BACnet controllers residing on the controller network; the other two ports shall have the ability to be configured for different protocols.

5. The BPT shall provide full custom programmability of the data flowing between the networks, using the same graphic programming as specified herein. The system shall have the ability to create custom building control strategies using global data between networks.

2.08 PANELS

A. Cabinet: Each DDC Controller shall be enclosed in a field panel or equipment enclosure with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face. The field panel cabinet shall be general purpose utility enclosures with enameled finished face panel. Provide sufficient access for wire and conduit to enter the cabinet. Each of the field control panel locks for the project shall be keyed alike.

1. Locations outdoors and/or in wet ambient conditions: Provide waterproof enclosure rated for operation at 32-122 degrees F.
2. Locations in conditioned space: Provide dustproof enclosure

B. Each panel shall include the following:

1. Receptacles: Provide a 20 ampere duplex receptacle inside or immediately adjacent to the field control panel.
2. Master Disconnect Switch: Provide a master electrical power disconnect switch inside the field control panel to disconnect the external power to the cabinet for maintenance and repair. The disconnect switch shall not affect the duplex receptacle hereinbefore specified.
3. Terminal Strips: Provide screw type terminal strips in the field control panel for the termination of field wiring. Lay out terminal strips in a neat and orderly fashion and label each termination. Wiring entering the panel shall be routed through the panel wire-ways in a neat and workmanlike manner, properly tied or laced and terminated.

2.09 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.10 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).
   1. LAN Capacity: Not less than 60 stations or nodes.
   3. LAN Data Speed: Minimum 100 MBps
   5. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.
   6. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.
   7. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.

2.11 CONTROLLER SOFTWARE

A. The system shall continuously perform DDC functions at the local control module in a stand alone mode. The operator shall be able to design and modify the control loops to meet the requirements of the system being operated. The operators shall use system-provided displays for tuning of PID loops. These displays shall include the past three input variable values, the setpoint for the loop, the sample interval and the results of the PID effects on the final output.
B. Each control module shall perform the following functions:
   1. Identify and report alarm condition.
   2. Execute each application program indicated in the sequences of operation.
   3. Execute DDC algorithms.
   4. Trend and store data.
   5. Maintain time-of-day schedules.

C. Software Integration: The programs should be integrated into a single working system and each of the above functions should be executed in real time and automatically when needed, such as to optimize the controlled equipment.

D. System Security: User access secured via user passwords and user names.

E. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.
   2. Exception Schedules:
      a. Based on any day of the year.
      b. Defined up to one year in advance.
      c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
   3. Holiday or Special Schedules:
      a. Capability to define up to 99 schedules.
      b. Repeated annually.
      c. Length of each period is operator defined.

F. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

G. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.
      b. Alarms to be routed to appropriate workstation.

H. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

I. Sequencing: Application software based upon specified sequences of operation

J. PID Control Characteristics:
   1. Direct or reverse action.
   2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.

K. Power Failure/Automatic Restart:
1. Power failures shall cause the control module to go into an orderly shutdown with no loss of program memory.
2. Upon resumption of power, the Control module shall automatically restart and printout the time and date of the power failure and restoration at the respective OID.
3. Prior to taking action, the controller shall look at the actual time-of-day and the programmed schedule for the controlled systems. If systems are operating, the restart program shall automatically restart affected field equipment. The operator shall be able to define an automatic power up time delay for each piece of equipment under control.

L. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

M. Energy Calculations:
1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

N. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

O. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

P. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.
2.12 INPUT HARDWARE

A. Temperature Sensors: Vibration and corrosion resistant, for wall, immersion, or duct mounting as required.

1. General purpose temperature sensors
   a. Accuracy: +/-0.5 degrees F at calibration point.

2. Outside Air Temperature Sensors
   a. Description: Designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
   b. Accuracy: within +/- 1 degrees F in the range of -52 degrees F to 120 degrees F.

3. Room Temperature Sensors:
   a. Description: Steel cover plate with insulated back and security screws. Color per architect.

4. Room temperature sensors with slide switch
   a. Description: Construct for surface mounting. Provide setpoint reset slide switch with an adjustable temperature range.
   b. Accuracy: +/-0.5 degrees F in the range of 32 degrees F to 96 degrees F.

5. Room Temperature Sensors with Integral Digital Display:
   a. Description: Construct for surface mounting with four button keypad with the following capabilities:
      1) Indication of space temperature.
      2) Setpoint adjustment to accommodate room setpoint,
      3) Display and control fan operation status.
      4) Manual occupancy override and indication of occupancy status.
      5) Controller mode status.

6. Thermo wells:
   a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure. Thermo wells and sensors shall be mounted in a threadolet or 1/2” NFT saddle and allow access to the sensor for repair or replacement. Thermo wells shall be constructed of 316 stainless steel.

7. Ceiling and Recessed Mount Temperature Sensors:
   a. Description: Ceiling-mounted sensor in a low-profile housing.

8. Temperature Averaging Elements
   a. Accuracy: +/- 1 degrees F.
   b. Applications: Use on duct sensors for ductwork 10 sq ft or larger, where prone to stratification and for all mixed air and heating coil discharge sensors regardless of duct size.

9. Duct Mount Sensors

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a. Description: Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

B. Humidity Sensors: Vibration and corrosion resistant, for wall, immersion, or duct mounting as required.
   1. Room Sensors
      a. Description With locking cover, matching room temperature sensors, span of 25% to 90% R.H.
      b. Accuracy: ± 3% of operating range, with linear output
   2. Duct and Outside Air Sensors
      a. Description: With element guard and mounting plate, range of 0% to 100% R.H., with repeatable accurate readings from 10% to 90% R.H.
      b. Accuracy: ± 1% of operating range, with linear output

C. Differential Air Pressure Sensors
   1. Manufacturers:
      a. Setra
      b. Mamac
      c. Automation Components Inc. (ACI)
      d. Greystone
   2. Description: Air Static Pressure and Differential Pressure Sensors shall consist of a probe with pressure transducer designed to transmit a proportional 4 to 20 mA or 0-10VDC output in response to variation of differential pressure at air pressure sensing points. Pressure transmitters shall be selected with suitable range for expected input, temperature compensated, and constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
   3. Accuracy: 2% of full scale with repeatability of 0.5%.
   4. Range:
      a. Building Static Pressure Range: 0 inch to 0.25 inch wg.
      b. Duct Static Pressure Range: 0 inch to 5 inches wg.
      c. End of Line Primary Fan System Discharge Duct Static Pressure Range: 0 to 4 inches wg.
      d. Return Air and Outside Air Static Pressure Range: -2 to +2 inches wg.

D. Airflow Measuring Sensors (AFMS)
   1. Thermal Dispersion Type
a. Description: Thermal airflow stations with one or more bead-in-glass thermistor sensor nodes mounted in a probe with a stainless steel mounting bracket, and a remotely mounted microprocessor-based transmitter at each measurement location compatible with BMS. Provide the number of independent sensor nodes as recommended by the airflow station manufacturer based on the duct size.

b. Sensing-Node Temperature Accuracy: Within 0.15 deg F (0.08 deg C) over an operating range of minus 20 to plus 160 deg F (minus 28.9 to plus 71.1 deg C) and humidity range of 0 to 100 percent RH.

c. Airflow Station Accuracy: Within 3 percent of reading for ducted applications, and within 5 percent of reading for non-ducted applications.

E. Status and Safety Switches

1. General Requirements and application: Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

   a. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg. or current sensing switch, as indicated on the control diagrams.

   b. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 5 psig to 1.5 times the design pump operating pressure differential, or current sensing switch, as indicated on the control diagrams.

   c. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

2. Current Sensing Switches

   a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.

   b. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

3. Air Filter Status Switches

   a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.

   b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
c. Provide appropriate scale range and differential adjustment for intended service.

4. Air Flow Switches
   a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.

5. Air Pressure Safety Switches
   a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
   b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.

6. Water Flow Switches
   a. Bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor-proof type.

7. Low Temperature Limit Switches
   a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
   b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be serpentinied across the leaving side of the coil surface in accordance with manufacturers recommended installation procedures.
   c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

8. Damper Position Indication
   a. Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

F. Carbon Dioxide Sensors: Electronic, designed to monitor CO2 levels in HVAC systems for use in demand controlled ventilation systems according to ASHRAE Standard 62. Units shall have linear analog output of 0-10VDC/4-21mA, over a range of 0-3000 ppm of CO2. Units shall be furnished with a 5-year calibration guarantee.

G. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment, flush mounting for finished areas (offices, entries, etc.), and wall mounted for storage areas, garages, shops, etc.

2.13 CONTROL VALVES

A. General: All automatic control valves shall be factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of the piping system in which the valve is being installed, and be suitable for the system flow conditions and close against the differential pressures involved. Valves
shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified.

B. Sizing and application: Valves shall be globe, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer’s recommendations for the given application.

1. Liquid Control Valves (water and glycol)
   a. Two-position service: Line size unless otherwise indicated.
   b. Two-way modulating service (non-pressure independent): Pressure drop shall be equal to the pressure drop through heat exchanger (load), 50 percent of the pressure difference between supply and return pipe mains, or 5 psi whichever is greater. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
   c. Three-way modulating service: Pressure drop equal to the pressure drop through the coil exchanger (load), 5 psi maximum.
   d. For pressure independent valves, select for a differential pressure range of 5 to 50 psig.
   e. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
      1) Two-way: 150 percent of total system (pump) head.
      2) Three-way: 300 percent of pressure differential between ports A and B at design flow or 100 percent of total system (pump) head.

C. Ball Valves NPS 2 and Smaller:
   1. Description: Forged brass body with nickel plating, characterized stainless steel ball and trim, and Teflon seats and seals.
   2. Application: Characterized Ball valves shall be used for hot and condenser water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.
   3. Manufacturers:
      a. Belimo CCV
      b. Siemens
      c. Johnson Controls

D. Globe Pattern:
   1. Application: Modulating valves of the single-seat type with equal percentage flow characteristics shall be used for all AHU, ERU and special applications as indicated.
   2. Manufacturers:
      a. Belimo
      b. Siemens
3. Up to 2 inches (50 mm): Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.

4. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and stainless steel disc.

5. Hydronic Systems:
   a. Rate for service pressure of 125 psig at 250 degrees F.
   b. Replaceable plugs and seats of stainless steel.
   c. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.

E. Terminal Unit Control Valves:
   1. Bronze or brass body, bronze trim, two- or three-port as indicated, stainless steel ball union and threaded ends, 100 psi close-off rating.
   2. Rating: Class 125 for service at 862 kPa (125 psig) and 121 deg C (250 deg F) operating conditions.
   3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.14 DAMPERS

A. General: The BMS Contractor shall furnish all automatic dampers unless provided as standard from equipment manufacturer. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.

B. Sizing and Application: All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear. All dampers used for two-position, open/close control and mixing boxes shall be parallel blade type arranged for normally open or closed operation, as required.

C. Airfoil Blade Dampers
   1. General: Double skin construction with linkage out of the air stream
   2. Manufacturers:
      a. Johnson Controls D-7250 D-1250 or D-1300
      b. Ruskin CD50
      c. Vent Products 5650.
      d. Tamco
   3. Application: whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5” w.g., but no more than 4000 FPM or 6” w.g.

D. One-Piece Rolled Blade Damper
   1. Manufacturers:
      a. Johnson Controls D-1600
b. Ruskin CD36

c. Vent Products 5800

d. Tamco

2. Performance: Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48”x48” size shall not leak in excess of 8.0 cfm per square foot when closed against 4” w.g. static pressure when tested in accordance with AMCA Std. 500.

3. Construction:
   a. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.
   b. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.
   c. Blade Seals: Synthetic elastomeric inflatable mechanically attached, field replaceable.
   e. Shaft Bearings: Oil impregnated sintered bronze.
   f. Linkage Bearings: Oil impregnated sintered bronze.

4. Application: face velocities of 1500 FPM or below.

2.15 ACTUATORS

A. General: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action over the entire operating range. Provide proportional or two-position type as indicated in the sequence of operation, with current limiting circuitry or microprocessor overload protection.

B. Manufacturers:
   1. Johnson Controls
   2. Honeywell
   3. Belimo
   4. Siemens

C. Electronic Damper Actuators
   1. Modulating and two-position actuators shall be provided as required by the sequence of operations and as indicated on drawings. Damper sections shall be sized based on actuator manufacturer’s recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction and a gear release to allow manual positioning.
   2. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal.
of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

3. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as “quick acting,” shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

4. Electronic damper actuators shall be direct shaft mount.

D. Electronic Valve Actuators:

1. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer’s recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.

2. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

3. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or heat exchanger.

2.16 WIRE, CABLE AND NETWORK ACCESSORIES

A. Exposed cables installed in air plenums shall be specifically listed for air plenum use. (See specifications for specific wire and cable installation requirements.)

B. Cables, both fiber and copper, shall be as recommended by the manufacturer of the BAS, and shall be as required to support the specified LAN BACnet transmission type.
C. Network Repeater: Provide network repeaters as required to isolate and boost RS-485 signals. Provide power connection and NEMA enclosure as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

B. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

C. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

D. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

E. Provide conduit and electrical wiring in accordance with Section 26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

F. Combination fire Smoke dampers shall be installed by division 23, powered by division 26, interconnecting control wiring between duct mounted smoke detector and fire/smoke damper by BMS contractor, alarm points, status/position, shut down of unit and notification by BMS contractor.

G. Furnish and install all access doors.

H. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.

3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

4. Class 2 Wiring
   a. All exposed Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
   c. The use of plenum rated cable, not in conduit, in areas such as drop ceilings and wall cavities is acceptable.
   d. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

5. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

I. BMS Line Voltage Power Source
   1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 26.
   2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
   3. DDC terminal unit controllers may use AC power from motor power circuits.

J. BMS Raceway
   1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 3/4”.
   2. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
   3. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

K. Penetrations
   1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.

3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.

4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

L. BMS Identification Standards
1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
   a. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

M. BMS Panel Installation
1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer’s recommendations.

2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

3.03 COMMISSIONING

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. The Contractor shall provide the services of a factory authorized service representative to assist an independent commissioning agent to start up the BAS, and to commission each component included in the BAS.

C. Controls and Safeties: Test, and set each of the digital and analog sensing and actuating devices. Test each instrumentation device by making a comparison between the central computer or field control panel display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be tested. Record the measured value and displayed value for each device in the Commissioning Report.

D. Operational Tests: The Contractor shall conduct an operational test of each system and subsystem, including each of the associated field control panels, components, and field devices, to verify the proper sequence of operation and the actual performance of the installed BAS subsystem.

E. Documentation: Provide written documentation of the system commissioning and performance verification processes described above, including an itemized inspection and validation report complete with dates and second test results, and a performance test report for each system and each Sequence of Operation.
3.04 DEMONSTRATION AND INSTRUCTIONS

A. General: The contractor shall demonstrate the operation of the BAS hardware, software, and each of the related components, systems and subsystems to the satisfaction of the Owner. The Contractor shall schedule the demonstration with the Owner’s representative at least 2 weeks in advance of the proposed demonstration. Demonstration shall not be scheduled until each of the hardware and software submittals, and the Commissioning Test Report are received and approved. If the work fails to conform to Contract specifications, scheduling of additional site visits by the Contractor for re-demonstration is required.

B. Personnel and Equipment: The Contractor shall supply the required personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, paper, etc. The contractor-supplied personnel shall be competent with and knowledgeable of the project-specific hardware, software, and the HVAC systems. Complete training documentation and a complete copy of the BAS submittals shall be on file at the job site.

C. Physical Demonstration of Response to System Conditions: System acceptance shall include demonstrations that each of the components function properly by actual response to system conditions that may be encountered. The Contractor shall furnish the materials such as sources of temporary heating and cooling necessary to cause the system components to go through the required sequences. Computer simulations of possible operating conditions are not acceptable for demonstration of system performance. Proposed methods of demonstrating component operation shall be submitted to the Owner. Representatives of Owner will also witness the tests.

D. Orientation and training: Provide services of qualified technical personnel for three 6-hour days at project site to instruct Owner’s personnel in operation and maintenance of the installed BAS.

3.05 ACCEPTANCE

A. Upon completion of the installation and commissioning of the systems, the contractor shall notify the owner’s representative in writing, together with a copy of the commissioning report, that the system is complete and ready for acceptance testing. The owner’s representative shall schedule a starting day for system acceptance testing. The contractor shall demonstrate calibration, testing, and adjusting of points or systems selected by the owner’s representative. After an adequate sampling of points and sequences have been verified to satisfy the owner’s representative that the system is performing in accordance with the contract documents, the system shall be accepted and the warranty period shall begin.
3.06 MAINTENANCE

A. See Section 01 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of energy management and control systems for one year from Date of Substantial Completion.

C. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

D. Provide complete service of systems, including service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION
SECTION 23 09 95
VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controllers.

1.2 RELATED SECTIONS

A. Section 230400 – General Conditions for Mechanical Trades.

B. Section 230500 – Common Work Results for HVAC.

C. Section 232123 – HVAC Pumps.

D. Section 237413 – Outdoor Central Station Air Handling Units

E. Section 230993 – Sequence of Operations

F. Division 26 – Electrical

1.3 REFERENCES


B. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).


E. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

A. Division 1 – Submittal Procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; clearance requirements; and nameplate legends.

1.5 SUBMITTALS FOR INFORMATION

A. Division 1 and Section 01 33 00 - Submittals: Submittals for information.

B. Test Reports: Indicate field test and inspection procedures and test results.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.6 SUBMITTALS FOR CLOSEOUT

A. Division 1 – Closeout Procedures.

B. Operation Data: NEMA ICS 3.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

C. Maintenance Data: NEMA ICS 3.1. Include routine preventive maintenance schedule.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing variable frequency controllers with minimum three years documented experience, and with service facilities within 100 miles of Project.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc as suitable for the purpose specified and indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 - Product Requirements.

B. Accept controllers on site in original packing. Inspect for damage.
C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.10 MAINTENANCE SERVICE

A. Provide service and maintenance of controller for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB Industrial Systems

B. Toshiba International Corporation

C. Square D

D. Substitutions: Section 01 60 00 - Product Requirements.

2.2 DESCRIPTION

A. Enclosed variable frequency controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7.

B. Select unspecified features and options in accordance with NEMA ICS 3.1.

2.3 RATINGS

A. Rated Input Voltage: As scheduled on the drawings.

B. Motor Nameplate Voltage: As scheduled on the drawings.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

2.4 DESIGN

A. Employ microprocessor-based inverter logic isolated from power circuits.
B. Employ pulse-width-modulated inverter system.

C. Design for ability to operate controller with motor disconnected from output.

D. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

2.5 PRODUCT OPTIONS AND FEATURES

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Volts Per Hertz Adjustment: Plus or minus 10 percent.

D. Current Limit Adjustment: 60 - 110 percent of rated.

E. Acceleration Rate Adjustment: 0.5 - 30 seconds.

F. Deceleration Rate Adjustment: 1 - 30 seconds.

G. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.

H. Input/Output Signals:
   1. 4-20 mA input central signal.
   2. 4-20 mA output feedback signal.
   3. Contact closure for general alarm output.
   4. Input contact for on/off control.

I. Control Power Source: Integral control transformer.

J. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

K. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

L. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

M. Manual Bypass: As specified on plans, furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the...
motor. Include isolation switch to allow maintenance of inverter during bypass operation.

N. Emergency Stop: Accommodate the use of dynamic brakes for emergency stop function.

O. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller.

2.6 FABRICATION

A. Wiring Terminations: Match conductor materials and sizes indicated.

B. Enclosure: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.

C. Finish: Manufacturer’s standard enamel.

2.7 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

B. Allow witnessing of factory inspections and tests at manufacturer’s test facility. Notify Owner at least 7 days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

C. Verify that field measurements are as indicated on shop drawings.

3.2 INSTALLATION

A. Install per manufacturer’s instructions and in accordance with NEMA ICS 3.1.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Provide fuses in fusible switches; refer to Division 26 for product requirements.

D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
E. Provide engraved plastic nameplates; refer to Section 230553 for product requirements and location.

F. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.3 FIELD QUALITY CONTROL

A. Section 01 0 – Closeout Procedures.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.16.2.

3.4 MANUFACTURER’S FIELD SERVICES

A. Manufacturer’s representative shall be present during preparation and starting of systems.

B. Provide manufacture’s startup report.

3.5 ADJUSTING

A. Section 01 – Closeout Procedures.

B. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.6 DEMONSTRATION AND INSTRUCTIONS

A. Section 01 – Closeout Procedures.

B. Demonstrate operation of controllers in automatic and manual modes.

3.7 WARRANTY

A. The VFD Product Warranty shall be 36 months.

END OF SECTION
SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Heating water piping, above ground.
B. Coil condensate drain piping
C. Equipment drains and over flows.
D. Unions and flanges.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.03 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   3. ASME B31.9 - Building Services Piping.
   4. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.

B. Provide flanges, union, and couplings at locations requiring servicing. Use unions, flanges, and Grooved coupling couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

1.05 SUBMITTALS

A. Shop Drawings: Indicate layout of piping system, including equipment, critical dimensions, and sizes.
1. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and be specifically identified with the applicable Grooved coupling style or series number.
B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

C. Test Reports: Indicate results of piping system pressure test.

D. Welders’ Certificates.

1.06 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves equipment and accessories.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

C. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

1.08 QUALIFICATIONS

A. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

B. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53/A53M., black steel with plain ends; welded and seamless, Grade B.
2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

B. Steel Pipe, grooved joints: ASTM A53/A53M, black steel with grooved ends.
   1. Fittings: ASTM A536 ductile iron, or ASTM A53 forged steel or fabricated from carbon steel pipe, grooved ends designed to accept Grooved coupling standard or AGS “W” series couplings.
   2. Joints: Grooved mechanical couplings meeting ASTM F1476.
      a. Housing Clamps: ASTM A536 ductile iron, enamel coated, compatible with steel piping sizes, rigid or flexible type.
      1) Rigid Type: 2 inch through 12 inch: “Installation ready” rigid coupling with offsetting, angle pattern bolt pads designed for direct ‘stab’ installation onto grooved end pipe without prior disassembly of the coupling, no torque requirement and Grade “EHP” EPDM gasket.
      2) Rigid Type: 14 inch through 24 inch: AGS grooves, wide housing key with flat bolt pads. Grade “E” EPDM FlushSeal® gasket.
      3) Flexible Type: 2 inch through 24” inch: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three (3) couplings, for each connector, shall be placed in close proximity to the source of vibration.
      b. Grade “E” EPDM Gasket: Elastomer composition for operating temperature range from -30 degrees F to 230 degrees F.
      c. Grade “EHP” EPDM Gasket: Elastomer composition for operating temperature range from -30 degrees F to 250 degrees F.
      d. Accessories: Steel bolts, nuts, and washers.

C. Stainless Steel Pipe: ASTM A312, Schedule 10S for 2 inch and smaller, Type 304/304L, full finish annealed pipe.
   1. Fittings: Precision cold drawn austenitic stainless steel, Type 304/304L, complete with synthetic rubber O-rings.
   2. Joints: Press-seal
      a. O-rings: EPDM Elastomer composition for operating temperature range from -30 degrees F to 250 degrees F.
      b. 500 PSI rated

2.02 COPPER PIPE AND FITTINGS

A. Drawn-Temper Copper Tubing, solder joints: ASTM B88, Type K, L, or M as specified in part 3 for application.
1. Fittings:
   a. ASME B16.22, solder wrought copper.

2. Prohibited Tee Connections: Mechanically extracted collars with notched and dimpled branch tube (T-Drill) fittings are prohibited.

3. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

B. Drawn-Temper Copper Tubing, press-seal joints: ASTM B88, Type L or M as specified in section 3 for application.
1. Press Fittings: IAPMO PS 117, ANSI LC1002, NSF61-G
2. Housing: Copper.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200-psig working-pressure rating at 250 deg F.

2.03 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150 malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered.
3. Dielectric Connections:
   a. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   b. Waterway fitting with zinc electroplated steel or ductile iron body, male thread, grooved, or plain end, water impervious isolation barrier.
4. PVC Piping: PVC.
5. Plastic-to-metal transition unions: Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping:
   a. Class 150 forged steel, slip-on flanges.
   b. Grooved joint flange adapter, flat face, for direct connection to ANSI Class 125 and 150 flanges. For direct connection to ANSI Class 300 flanges
   c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
2. Copper Piping:
   a. Class 150, slip-on bronze flanges.
   b. Grooved joint flange adapter, flat face, for direct connection to ANSI Class 125 and 150 flanges.
3. PVC Piping: PVC flanges.
C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

PART 3 EXECUTION

3.01 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, 2-inch and smaller, shall be the following:
   1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and press-seal joints [where exposed and where installed above accessible ceilings only].

B. Hot-water heating piping, aboveground, 2-1/2 inch and larger shall be any of the following:
   1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and press-seal joints [where exposed and where installed above accessible ceilings only].
   3. Schedule 40 steel pipe [0.375 inch wall for sizes 12 inch and larger,], wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
   4. Schedule 40 steel pipe [0.375 inch wall for sizes 12 inch and larger,], grooved, mechanical joint coupling and fittings; and grooved, mechanical joints [where exposed and where installed above accessible ceilings only].

C. Makeup-water piping installed aboveground shall be the following:
   1. Type L (Type B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

E. Air-Vent Piping:
   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer’s written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

F. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer’s written instructions.
3.02 EXAMINATION
   A. Verify excavations are to required grade, dry, and not over-excavated.

3.03 PREPARATION
   A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
   B. Remove scale and dirt on inside and outside before assembly.
   C. Prepare piping connections to equipment with flanges or unions.
   D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
   E. After completion, fill, clean, and treat systems. Refer to Section 23 25 00.

3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS
   A. Install pipe hangers and supports in accordance with Section 23 05 29.

3.05 INSTALLATION - ABOVE GROUND PIPING SYSTEMS
   A. Install Work in accordance with Owner’s guidelines.
   B. Route piping parallel to building structure and maintain gradient.
   C. Install piping to conserve building space, and not interfere with use of space.
   D. Group piping whenever practical at common elevations.
   E. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.
   F. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
   G. Install pipe identification in accordance with Section 23 05 53.
   H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
   I. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
   J. Slope hydronic piping and arrange systems to drain at low points.
   K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
L. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 90 00.

M. Install valves with stems upright or horizontal, not inverted.

N. Insulate piping and equipment; refer to Section 23 07 00.

3.06 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved joint piping systems: Install in accordance with the manufacturer's guidelines and recommendations.
   1. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing.
   2. A factory trained field representative shall provide on-site training to contractor's field personnel in the installation of grooved piping products. Factory trained representative shall periodically review the product
3. Use roll sets or cut groovers compatible with the pipe material and wall thickness per manufacturer’s installation instructions.

I. Press connections: Copper and copper alloy press connections shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) recommended by the manufacturer. Contractor shall be trained on the use and installation of the system by manufacturer’s representative.

3.07 FIELD QUALITY CONTROL

A. Comply with Division 1.

B. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.
   2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
   4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
   5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

C. Perform the following tests on hydronic piping:
   1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
   2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
   3. Isolate expansion tanks and determine that hydronic system is full of water.
   4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system’s working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping." Pressure test for press-seal fittings shall not exceed 85 psi. If there is a significant drop in pressure, the system shall be walked to check for unpressed fittings. Should an un-pressed fitting be located, the pressure
should be released from the system and the un-pressed fitting shall be pressed.

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

D. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

E. Test hydronic piping systems in accordance with [ASME B31.9].

F. Pressure test to identify un-pressed fittings: Utilizing air or water, the system shall be pressurized, not to exceed 85 psi. If there is a significant drop in pressure, the system shall be walked to check for un-pressed fittings. Should an un-pressed fitting be located, the pressure should be released from the system and the un-pressed fitting shall be pressed. If no un-pressed fitting is identified the system shall be pressurized to test pressures required by code, not to exceed 600 psi.

G. HANGERS AND SUPPORTS
1. Comply with requirements in Division 23 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
<table>
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<th>PIPE SIZE Inches</th>
<th>COPPER TUBING MAXIMUM HANGER SPACING Feet</th>
<th>STEEL PIPE MAXIMUM HANGER SPACING Feet</th>
<th>COPPER TUBING HANGER ROD DIAMETER Inches</th>
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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air vents.
B. Balancing valves.
C. Combination flow controls.
D. Relief valves.
E. Pressure reducing valves.
F. Thermometers
G. Pressure Gauges

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Section 22 - Plumbing Piping Specialties: Backflow preventers.
C. Section 23 - Hydronic Piping.
D. Section 23 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS (follow the most currently adopted amended version)

B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard.
C. ASME B16.11 - Forged Fittings, Socket-welding and Threaded.
D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of work of this section with size, location and installation of service utilities.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Maintenance Contract.

E. Project Record Documents: Record actual locations of flow controls.

F. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Glycol Solution: One container, 1 gallon size.
   2. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flow meter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 AIR VENTS

A. Manufacturers:
   2. ITT Bell & Gossett
   3. Taco, Inc.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:
   1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.2 PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:
   1. Ferguson Enterprises Inc
   2. Peterson Equipment Company Inc
   3. Sisco Manufacturing Company Inc
   4. Substitutions: See Section 01 - Product Requirements.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.3 BALANCING VALVES - MANUAL

A. Manufacturers:
   1. Armstrong Fluid Technology
   2. ITT Bell & Gossett
   3. Taco, Inc
   4. Nexus
   5. Grisworld
   6. Tour & Anderson
B. Brass or Bronze, Calibrated-Orifice, Balancing Valves:
1. Construction: Bronze or brass alloy housing, ball or plug type with calibrated orifice or venturi. The valve shall come fully assembled and be permanently marked to show direction of flow.
2. CWP rating: 400PSI/250°F.
3. Pressure gauge connections: dual pressure/temperature test valves for flow reading, and a union end which will accept various end pieces.
4. The body design shall allow inspection or repair of handle operated stem without disturbing piping connections. The repairable stem shall include two Teflon seals and one EPDM O-ring for protection against chemicals and modulating temperature.

2.4 COMBINATION FLOW CONTROLS

A. Manufacturers:
1. Armstrong Fluid Technology
2. ITT Bell & Gossett
3. Taco, Inc
4. Nexus
5. Grisworld

B. Size 2 inch and Under:
1. 300 psi, threaded or soldered ends; non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting. Victaulic / TA Hydronics Series 787, 78K STAD or 786 STAS.

C. Size 2-1/2 inch and Larger:
1. 250 psi Flanged or 350 psi Grooved ends, ASTM A536 ductile iron body, all other metal parts of Ametal® brass copper alloy, EPDM O-ring seals. 8, 12 or 16 turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting. Victaulic / TA Hydronics Series 789 STAG or 788 STAF
2. Coil hook-up assemblies may be used to reduce installation time and space requirements. Victaulic TA Series 799 or 79V Koil Kit coil pack assembly. Coil pack can include; Victaulic Series 78U union port fitting, Series 78Y strainer/ball valve or Series 78T union/ball valve combination, and two flexible hoses

2.5 PRESSURE REDUCING VALVES

A. Manufacturers:
1. Armstrong International, Inc
2. ITT Bell & Gossett
3. Taco, Inc
4. Watts
B. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 2113.

C. Construction
1. Valve Body: Constructed of bronze, cast iron, brass, iron
2. Disc: Glass and carbon-filled PTFE.
5. Diaphragm: EPT.

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 100 psi (689 kPa).

F. Maximum Fluid Temperature: 180 degrees F (82 degrees C).

G. Operating Pressure Range: Between 10 psi (69 kPa) and 25 psi (172 kPa).

2.6 THERMOMETERS

A. Manufacturers:
1. Trerice
2. Winters
3. Weiss

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
1. Size: Minimum 7 inch scale.
2. Window: Clear glass or Lexan.
3. Stem: Aluminum or Brass, length to suit installation.
4. Accuracy: ASTM E77 2 percent.
5. Calibration: Degrees F, or both degrees F and degrees C.

2.7 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.8 PRESSURE GAUGES

A. Manufacturers:
1. Trerice
2. Winters
3. Weiss
B. Gauge: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
   1. Case: Sealed types, Aluminum or Stainless steel.
   2. Movement: Mechanical, with link to pressure element and connection to pointer.
   3. Dial Size: Minimum 4-1/2 inch diameter.
   4. Mid-Scale Accuracy: Grade A, plus or minus one percent.
   5. Scale: Psi, or both psi and kPa.

PART 3 EXECUTION

3.1 INSTALLATION – HYDRONIC PIPING SPECIALTIES

A. Install specialties in accordance with manufacturer's instructions.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes. Install thermowells with extension on insulated piping. Fill thermowells with heat-transfer medium.

C. Install gauges and thermometers in locations where they are easily read from normal operating level.

D. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

E. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

F. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position. Install valve and snubber in piping for each pressure gauge for fluids (except steam).

G. Install thermowells with socket extending one-third of pipe diameter or to center of pipe and in vertical position in piping tees.

H. Where large air quantities can accumulate, provide enlarged air collection standpipes.

I. Provide manual air vents at system high points and as indicated.

J. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

K. Provide air separator on suction side of system circulation pump and connect to expansion tank.

L. Provide drain valve and hose connection on strainer blow down connection.
M. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

N. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

O. Support pump fittings with floor mounted pipe and flange supports.

P. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

Q. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

R. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, expansion tanks, and elsewhere as required by ASME Boiler and Pressure Vessel Code. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

S. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

T. Pipe relief valve outlet to nearest floor drain.

U. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

V. Clean and flush glycol system before adding glycol solution. Refer to Section 23 25 00 -HVAC Water Treatment.

W. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at [height of the building] times .433psi/ft + 5 psi.

X. Perform tests determining strength of glycol and water solution and submit written test results.

3.2 INSTALLATION - THERMOMETERS AND GAUGES

A. Install one pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gauge.

B. Install pressure gauges with pulsation dampers. Provide needle valve or ball valve to isolate each gauge. Extend nipples to allow clearance from insulation.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
D. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

E. Coil and conceal excess capillary on remote element instruments.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.3 THERMOMETER SCALE RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F

3.4 PRESSURE GAUGE SCALE RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 200 psi

3.5 MAINTENANCE

A. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.

B. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.

C. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Duct Materials.
B. Duct Liner
C. Insulated flexible ducts.
D. Single wall spiral round ducts.
E. Kitchen hood exhaust ductwork fabrication.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.03 REFERENCES

A. ASTM International:
2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
4. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

B. National Fire Protection Association:
2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

C. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - Fibrous Glass Duct Construction Standards.
3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" beef up duct hanger and support in this section.

C. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
3. Fittings.
4. Reinforcing details and spacing.
5. Seam and joint construction details.
6. Penetrations through fire rated and other walls.
7. Terminal unit, coil, and humidifier installations.
8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

B. Product Data: Submit data for duct materials, duct liner, duct connectors.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.06 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards as applicable.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.
PART 2 PRODUCTS

2.01 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 (zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.


D. Stainless Steel Ducts: ASTM A480/A480M, Type [304.] [316.] Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article

E. Fasteners: Rivets, bolts, or sheet metal screws.

F. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 DUCT LINER

A. Fibrous-Glass Duct Liner
   1. Manufacturers:
      a. CertainTeed Corporation; Insulation Group.
      b. Johns Manville.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
      a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner:
   1. Manufacturers:
      a. Aeroflex USA Inc.
      b. Armacell LLC
      c. K-Flex
   2. Description: Elastomeric foam duct liner, integral EPA registered antimicrobial agent, complying with NFPA 90A or NFPA 90B.
3. Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
   a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 INSULATED FLEXIBLE DUCTS

A. Manufacturers:
   1. Thermaflex
   2. Technaflex
   3. Tuttle + Bailey
   4. Flexmaster

B. Product Description: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helical wound spring steel wire; fiberglass insulation; polyethylene or aluminized vapor barrier film.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   3. Temperature Range: -20 degrees F to 210 degrees F.
   4. Thermal Resistance: 6 square feet-hour-degree F per BTU.
   5. Vapor Barrier Permeance: 0.05 perm per ASRM E96, Procedure A

2.04 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
   1. General: Brush-on, water-resistant, mold and mildew resistant, indoor and outdoor use, compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
   2. Solids Content: Minimum 65 percent.
   4. VOC: Maximum 75 g/L (less water).
   5. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

C. Flanged Joint Sealant: Comply with ASTM C 920.
   2. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2.05 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers include, but are not limited to:
   1. McGill AirFlow Corporation
   2. Semco Incorporated
   3. Tangent Air Corp

B. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

C. Construct ducts and fittings gauge per the latest edition of SMACNA.

2.06 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. TDC connections on all ductwork where any dimension exceeds 12 inches. Slip and drive connection acceptable on duct sizes less than 12” x 12”.

C. Construct T’s, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide [airfoil] turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

G. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems.
   1. Sealants, Mastics: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
2. Do not provide sealing products not bearing UL approval markings.

2.07 KITCHEN HOOD EXHAUST DUCTWORK FABRICATION

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.


C. Concealed Kitchen Hood Exhaust Ducts: Construct of 16 gage carbon steel or 18 gage stainless steel ASTM ASTM A240/A240M OR ASTM 666, type 316 using continuous external welded joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION

A. General:
1. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

2. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

3. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

4. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

5. Install duct hangers and supports in accordance with Section 23 05 29.

6. Use double nuts and lock washers on threaded rod supports.

7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

8. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

9. Do not route ducts through transformer vaults or electrical equipment rooms and enclosures.

10. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and HVAC DUCTS AND CASINGS

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duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

11. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23, Air Duct Accessories for fire and smoke dampers.

B. Buried Ducts
1. Slope underground ducts to plenums or low pump out points at 1:500. Install access doors for inspection.

C. Flexible ductwork
1. When located above ceilings, support flexible duct from above; flexible duct shall not touch the ceiling.
2. Minimize kinks and sags
3. Flexible duct shall be located only where concealed and accessible.
4. Non-insulated flexible ductwork: Provide when the metal ductwork connected to is not insulated.
5. Insulated flexible ductwork: Provide when the metal ductwork connected to is insulated. R-value of flexible ductwork insulation shall meet or exceed the R-value of the metal ductwork insulation.
6. Elbow supports: Provide above flexible ductwork connections to ceiling diffusers. Use cable ties as indicated in the manufacturer’s installation instructions.
7. Connections to rigid ductwork: Provide both a drawband and two layers of duct tape lapped approximately 25% at each connection of flexible ductwork to rigid ductwork. Drawbands shall be the non-metallic type listed and labeled in accordance with UL 181B. Duct tape shall be listed and labeled in accordance with UL 181B.

D. Kitchen Hood Exhaust Ducts
1. Install kitchen range hoods in accordance with NFPA 96. Refer to Section 11 40 00.
2. Install residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out.
3. Kitchen hood exhaust ducts: Use stainless steel for ductwork exposed to view and stainless steel or carbon steel where ducts are concealed.

E. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.

3.03 DUCT SEALING

A. Duct Seal Level Description

<table>
<thead>
<tr>
<th>Seal Level</th>
<th>Sealing Requirements*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All transverse joints, longitudinal seams, and duct wall penetrations. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL0181B by</td>
</tr>
</tbody>
</table>
an independent testing laboratory and the tape is used in accordance with that certification

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>All transverse joints, longitudinal seams. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL0181B by an independent testing laboratory and the tape is used in accordance with that certification.</td>
</tr>
<tr>
<td>C</td>
<td>Transverse joints only.</td>
</tr>
</tbody>
</table>

Notes:
Longitudinal seams are joints oriented in the direction of flow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod, or wire. Spiral lock seams in a round or flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps, and other branch connections, access door frames and jambs, duct connections to equipment, etc.

### B. Minimum Duct Seal Levels

<table>
<thead>
<tr>
<th>Duct Type</th>
<th>Supply</th>
<th>Exhaust</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct Location</td>
<td>2-in. or less (1)</td>
<td>Greater than 2-in. (1)</td>
<td></td>
</tr>
<tr>
<td>Outdoor</td>
<td>A</td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Unconditioned Space (2)</td>
<td>B</td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Conditioned Space</td>
<td>C</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

**Notes:**
Duct design static pressure classification
Includes indirectly conditioned spaces such as return air plenums

#### 3.04 INTERFACE WITH OTHER PRODUCTS

**A.** Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

**B.** Connect air terminal units to supply ducts directly or with five foot maximum length of flexible duct. Do not use flexible duct to change direction.
3.05 CONCEALED GREASE DUCT TESTING

A. Prior to concealing, wrapping, or insulating grease ductwork, or placing grease duct in service, perform leakage test in accordance with ICC IMC, in presence of authority having jurisdiction.

B. Perform light test by pulling minimum 100 W light through duct and observing for light leaks at duct joints.

C. Test complete extent of duct installed, including joint at which duct connects to exhaust hood.

3.06 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Duct cleaning is required if test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems." do not meet the following criteria:
   1. Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

D. Clean duct systems with high power vacuum machines. Protect equipment with potential to be harmed by excessive dirt with filters, or bypass during cleaning. Install access openings into ductwork for cleaning purposes.

3.07 DUCTWORK LEAKAGE TESTING

A. The following ductwork systems shall be pressure/leakage tested:
   1. All ductwork to be concealed in a sheetrock, concrete block or other permanent chase shall be pressure tested before ductwork is concealed.
   2. 2012 IECC REQUIREMENTS
      a. All ductwork systems listed below that are constructed and installed for 3” w.c. or more (positive or negative).
   3. For ductwork leakage testing: “Ductwork main” shall be defined as all ductwork serving more than two grille or diffuser.
   4. All ductwork outside of the building insulation envelope shall be pressure tested.

B. Testing shall conform to the following:
   1. Test static pressure must be the lower of 125% of the external static pressure of the air moving equipment or the construction static pressure class of the ductwork.
2. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Maximum Allowable Leakage shall be in accordance with Duct Pressure Class rating listed below and Leakage Class listed here-in.

3. For Ductwork Pressure Class 3” w.c: Leakage Class shall be 8.

4. For Ductwork Pressure Class 2” w.c or less: Leakage Class shall be 16.

5. Testing shall occur after ductwork has been cleaned, but before duct insulation is applied or ductwork is concealed.

C. Duct Leakage Test Report shall include:

1. Date of test.
2. Name of company and person conducting the test.
3. Name of company and person witnessing the test.
4. Description of ductwork tested. Provide drawings to indicate section of ductwork being tested. Labeling on the drawings shall correspond to labeling in the report.
5. Surface area (square feet) of section of ductwork being tested.
6. Duct design operating pressure (inches w.c.)
7. P = Duct design test static pressure (inches w.c.)
8. Duct capacity, air flow
9. CL = Specified Leakage Class.
10. F = Leakage factor (CFM / 100 sf of duct area)
11. Maximum allowable leakage (CFM)
12. Test apparatus
   a. Blower
   b. Orifice tube size
   c. Orifice size
   d. Calibrated
13. Test orifice differential pressure (inches w.c.)

3.08 SCHEDULES

A. Ductwork Material Schedule:

<table>
<thead>
<tr>
<th>AIR SYSTEM</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>Galvanized Steel</td>
</tr>
<tr>
<td>Return and Relief</td>
<td>Galvanized Steel</td>
</tr>
<tr>
<td>General Exhaust</td>
<td>Galvanized Steel</td>
</tr>
<tr>
<td>Kitchen Grease Exhaust</td>
<td>Carbon Steel, Stainless Steel</td>
</tr>
<tr>
<td>Dishwasher Exhaust</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Outside Air Intake</td>
<td>Galvanized Steel</td>
</tr>
</tbody>
</table>
### Ductwork Pressure Class Schedule:

<table>
<thead>
<tr>
<th>AIR SYSTEM</th>
<th>PRESSURE CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Ductwork (upstream of VAV boxes terminal units and/or final balancing damper)</td>
<td>3 inch wg</td>
</tr>
<tr>
<td>Supply Ductwork (downstream of VAV boxes and terminal units)</td>
<td>2 inch wg regardless of velocity.</td>
</tr>
<tr>
<td>Return and Relief</td>
<td>2 inch wg regardless of velocity.</td>
</tr>
<tr>
<td>General Exhaust</td>
<td>2 inch wg regardless of velocity.</td>
</tr>
<tr>
<td>Dishwasher Exhaust</td>
<td>2 inch wg</td>
</tr>
<tr>
<td>All Others Not Identified</td>
<td>1.5x maximum anticipated system pressure</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Back-draft dampers.
B. Combination fire-and-smoke dampers.
C. Duct access doors.
D. Dynamic fire dampers.
E. Smoke dampers.
F. Volume control dampers.
G. Flexible duct connections.
H. Duct test holes.

1.02 RELATED SECTIONS:

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Section 23 05 19 – Meters and Gauges
C. Section 23 04 00 – General Conditions for Mechanical Trades
D. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
E. Section 23 31 00 - HVAC Ducts: Requirements for duct construction and pressure classifications.
F. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.03 REFERENCES (follow the most currently adopted amended version)

A. Air Movement and Control Association International, Inc.:  
1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
B. ASTM International:

C. National Fire Protection Association:
   2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 555 - Standard for Safety for Fire Dampers.
   2. UL 555C - Standard for Safety for Ceiling Dampers.

1.04 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

B. Product Data: Submit data for shop fabricated assemblies and hardware used.

C. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Smoke dampers including locations and ratings.
   4. Flexible duct connections.
   5. Volume control dampers.
   6. Duct access doors.
   7. Duct test holes.

D. Product Data: For fire dampers, smoke dampers, combination fire and smoke dampers submit the following:
   1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

E. Manufacturer’s Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

F. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.
1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors test holes and dampers.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.06 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.08 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate Work where appropriate with building control Work.

1.12 WARRANTY

A. Furnish five-year manufacturer warranty for duct accessories.
1.13 EXTRA MATERIALS

A. Fusible Links: Furnish quantity equal to 10 percent of number installed.

PART 2 PRODUCTS

2.01 BACK-DRAFT DAMPERS

A. Manufacturers:
   1. Ruskin CB series
   2. Price BDD Series
   3. Greenheck EM Series

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, extruded aluminum. Blades, maximum 6 inch width, center pivoted, with flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Price
   3. Greenheck
   4. Pottorff
   5. Nailor

B. Type: Dynamic, fabricate in accordance with NFPA 90A, UL 555, and UL 555S.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Leakage Rating: Class II, maximum of 20 cfm at 4 inches wg differential pressure.

E. Damper Temperature Rating: 250 degrees F for all except smoke control systems. Smoke control systems must be 350 degrees F rated.

F. UL 555S Differential Pressure Rating: 6 in. wg.

G. UL 555S Velocity Rating: 2000 fpm

H. Frame: minimum 16 gage, galvanized steel.

I. Blades:
2. Action: Opposed or parallel.
3. Orientation: Horizontal.
5. Width: Maximum 6 inches.

J. Bearings: Stainless steel or Bronze Oilite pressed into frame.

K. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

L. Linkage: Concealed in frame.

M. Release Device: Electric resettable link to allow damper to be automatically reset with an open & closed indicator.

N. Actuator: shall be qualified in accordance with UL 555S to the temperature rating of the damper. Provide with damper

O. Operators: UL listed and labeled spring return electric type suitable for 120 volt, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

P. Fusible Link Release Temperature: 165 degrees F.

Q. Finish: Mill galvanized.

R. Factory installed sleeve provided with mounting angles. Furnish silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements. Provide out-of-partition type dampers with fire rated sleeve where conditions do not allow installation of damper within partition.

S. Smoke Detector: Duct mounted smoke detectors shall be furnished by Div. 28, installed by Div. 23. Power wiring by Div. 26, control wiring by Div. 28.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ruskin
   2. Elgen
   3. Greenheck
   4. Buckley
   5. Kees
   6. Pottorff

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
   1. Less than 12 inches square, secure with sash locks.
   2. Up to 18 inches Square: Furnish two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches.
   4. Larger Sizes: Furnish additional hinge.
   5. Access panels with sheet metal screw fasteners are not acceptable.

D. Materials
   1. Aluminum construction: Minimum 0.032” thick aluminum double wall door, minimum 0.032” thick aluminum frame. Provide for aluminum duct.
   2. Steel construction: Minimum 24 gauge galvanized double wall door, minimum 24 gauge galvanized frame. Provide for galvanized steel duct.

E. Low Pressure Rectangular (Non-Grease-Ducts):
   1. Door: For insulated ducts, provide double wall door with 1” or 2” insulation cavity – as necessary to accommodate required insulation. For non-insulated ducts, provide single wall door.
   2. Gasket: Closed cell neoprene.
   3. Hardware: Double (opposite side) cam latches or single cam latch with full length (piano style) hinge.
   4. Insulation: Glass fiber type, 1” thick for ductwork with up to 1” thick acoustical lining or insulation wrap, 2” thick for ductwork with 1-1/2” and over acoustical lining or insulation wrap.

F. Low Pressure Round & Oval Duct (Non-Grease Ducts),
   1. Insulated duct, low pressure (3” wg): Welded construction, 18 gauge galvanized steel, 24 gauge galvanized double wall door, double cam latches or single cam latch with full length (piano style) hinge, 2” thick glass fiber insulation.
   2. Non-Insulated duct, low pressure (6” wg): 16 gauge galvanized door, plated steel full length (piano style) hinge, zinc plated draw latch(es) and keeper(s), closed cell neoprene gasket.

G. Grease Ducts: 16 gauge galvanized door, 16 gauge cold rolled steel (CRS) frame, 2,300°F ceramic fire gasket, UL 1978 Listed. Provide access doors where indicated on the drawings and where cleanouts are required by IMC Section 506.3.
   1.
2.04 DYNAMIC FIRE DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Price
   3. Greenheck
   4. Nailor
   5. Pottorff

B. Fabricate in accordance with NFPA 90A and UL 555.

C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Dynamic Closure Rating: Dampers classified for dynamic closure to 2000 fpm and 4 inches wg static pressure.

E. Construction:
   1. Integral Sleeve Frame- Galvanized steel in gauges required by manufacturer’s UL listing. Length: Minimum 20 gage formed Sleeve length shall extend approximately 3” on either side of the wall or floor to facilitate joining the collar to the duct.
   2. Blades:
      a. Style: Curtain type, blades outside of airstream.
      b. Action: Spring or gravity closure upon fusible link release.
   3. Closure Springs: Type 301 stainless steel, constant force type, if required.

F. Fusible Link Release Temperature: 165 degrees F.

G. Mounting: Vertical or horizontal as indicated on Drawings.

H. Finish: Mill galvanized.

2.05 SMOKE DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Air Balance
   3. Greenheck
   4. Nailor
   5. Pottorff

B. Fabricate in accordance with NFPA 90A and UL 555S.
C. Fire Resistance: 1-1/2 hours through penetrations with fire resistance ratings of less than 3 hours and 3 hours through penetrations with fire resistance ratings of 3 hours or more.

D. Leakage Rating: Class I, maximum of 8 cfm at 4 inches wg differential pressure.

E. Damper Temperature Rating: 250 degrees F.

F. Frame: 16 gage, galvanized steel.

G. Blades:
   3. Orientation: Horizontal.
   5. Width: Maximum 6 inches.

H. Bearings: Stainless steel pressed into frame.

I. Seals: Silicone blade edge seals and flexible stainless steel jamb seals.

J. Linkage: Concealed in frame.

K. Operators: UL listed and labeled spring return electric type suitable for 120 volt, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

L. Sleeve: Factory installed 16 gage sleeve, minimum 12 inches long.

M. Finish: Mill galvanized.

N. Smoke Detector: Duct mounted smoke detectors are furnished by Div. 28, installed by Div. 23. Power wiring by Div. 26, control wiring by Div. 28.

2.06 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Ruskin
   2. Nailor
   3. Greenheck
   4. Flexmaster
   5. McGill Airflow
   6. Nailor
   7. Pottorff

Comment [AS1]: Add control dampers
B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Splitter Dampers:
1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
4. Single Blade Dampers: Fabricate for duct sizes up to 12 x 48 inch.

D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

E. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg..

F. Quadrants:
1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.07 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Ventfabrics Inc. Ventglas
2. United McGill
3. Elgen
4. DuroDyne
5. Ventfabrics
6. Ductmate Industries

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Materials: Flame-retardant or noncombustible fabrics.

D. Coatings and Adhesives: Comply with UL 181, Class 1.

E. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 3-1/2 inches wide attached to two strips of galvanized or aluminum sheet steel. Provide metal compatible with connected ducts.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F

1. Minimum Weight: 16 oz./sq. yd.
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F

1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F

J. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.08 DUCT TEST HOLES

A. Manufacturers:
1. Dwyer
2. Flow Kinetics
3. Air Balance
4. Substitutions: Division 01 - General Requirements.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.09 TURNING VANES

A. Manufacturers:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA’s “HVAC Duct Construction Standards - Metal and Flexible”; Figures 4-3, “Vanes and Vane Runners,” and 4-4, “Vane Support in Elbows.”

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment installation are ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.02 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Install motorized back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Access Doors: Install access doors of type suitable for application at the following locations:
1. Spaced every 50 feet of straight duct.
2. Upstream of each elbow.
3. Upstream of each reheat coil.
4. Before and after each duct mounted filter.
5. Before and after each duct mounted coil.
6. Before and after each duct mounted fan.
7. Before and after each automatic control damper.
8. Before and after each fire damper, smoke damper, combination fire and smoke damper.
9. Downstream of each VAV box.
10. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.

D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Install 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
   1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, OR FIRE DAMPER.

E. Install temporary duct test holes and required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

F. Install fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings and as indicated in specifications. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges. Install dampers and accessories with required clearance for access. Provide all power and control wiring for a complete and operable system.
   1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
   2. Install dampers square and free from racking with blades running horizontally.
   3. Do not compress or stretch damper frame into duct or opening.
   4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
   5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

3.03 DEMONSTRATION

A. Demonstrate re-setting of fire dampers to Owner’s representative.

Comment [AS4]: Remove all brackets

Comment [AS5]: Check references and revise
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof ventilators.
B. Inline centrifugal fans
C. Utility vent sets.
D. Motors and drives.
E. Fan accessories.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
B. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
C. Section 23 0700 - HVAC Insulation.
D. Section 23 3300 - Air Duct Accessories: Dampers.
E. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.
F. REFERENCE STANDARDS (follow the most currently adopted amended version) ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.
G. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.
H. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program.
L. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.,
M. NEMA MG 1 - Motors and Generators.

N. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

O. UL-705 – Standard for Safety for Power Ventilators

1.03 SUBMITTALS

A. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

B. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include complete installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Maintenance Materials: Furnish for Owner's use in maintenance of project.

F. Extra Materials:
   1. Fan Belts: One set for each individual fan.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.06 FIELD CONDITIONS

A. Permanent fans may not be used for ventilation during construction.

B. Permanent fans may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The following list of manufacturers applies to all fans unless otherwise noted in sections below.
   1. Greenheck Fan Corporation
   2. Loren Cook Company
   3. PennBarry
   4. Twin City Fan & Blower

2.02 STARTERS, DRIVES & DISCONNECTS

A. Provide starters and disconnect switches for all fans not scheduled to be controlled by a variable frequency drive.

B. Provide belt or direct drive fans as indicated on project schedules. Where belt drives are indicated provide the following:
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
   2. Belts: Static free and oil resistant.
   3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   4. Motor pulley adjustable for final system balancing.
   5. Readily accessible for maintenance.
   6. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

C. Disconnect Switches:
   1. Factory mounted and wired.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   3. Finish for Painted Steel Enclosures: Provide manufacturer's standard, factory applied gray, unless otherwise indicated.
   4. Positive electrical shutoff.
   5. Wired from fan motor to junction box installed within motor compartment.

2.03 ROOF CURBS

A. Provide roof curbs for all roof mounted fans and ventilators unless specifically noted otherwise.
B. Self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, factory installed nailer strip. Provide pitched roof curb where architectural roof plans indicate sloped roof.

C. Curb Height: 24 inches for intakes and 14 inches for exhausts.

2.04 INLINE CENTRIFUGAL FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

2.05 UTILITY VENT SET

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
   1. Refer to Section 2.1.

B. Motors:
   1. Totally Enclosed Fan Cooled (TEFC).
   2. Heavy duty ball bearing type.
   3. Mount on vibration isolators or resilient cradle mounts, out of air stream.
   4. Fully accessible for maintenance.

C. Housing:
   1. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
   2. Rigid internal support structure.
   3. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
   4. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.
   5. Provide breather tube for fresh air motor cooling and wiring.

D. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

E. Drain Trough: Allows for single-point drainage of water, grease, and other residues.
F. Accessories:
1. Automatic Belt Tensioner: Automatic device that adjusts for correct belt tension for single drives.

2. Birdsreen:
   a. Provide galvanized steel construction.
   b. Protects fan discharge.

3. Clean Out Port: Removable grease repellent compression rubber plug allows access for cleaning wheel through windband.

4. Drain Connection:
   a. Aluminum construction.
   b. Allows single-point drainage of grease, water, or other residues.

5. Finishes: Factory primed.

6. Grease Trap:
   a. Aluminum.
   b. Includes drain connection.
   c. Collects grease residue

7. Hinge Kit:
   a. Aluminum hinges.
   b. Hinges and restraint cables mounted to base (sleeve).
   c. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.


9. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.

10. External motor speed controllers for field mounting.

11. UL-762 Rating.

2.06 MIXED FLOW FANS

A. Manufacturers, Starters, Drives, Disconnects, and Roof Curbs
1. Refer to Section 2.1.

B. Hub and Impeller:
2. Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft; to facilitate indexing of blade angle with automatic adjustment stops.
3. Cast Components: X-ray components after fabrication and statically and dynamically balance assembly before attachment to motor or shaft.

C. Casing:
1. Fabricate casing of 1/4 inch steel for fans 40 inch in diameter and smaller and 3/8 inch steel for larger fans.
2. Continuously weld, with inlet and outlet flange connections, and motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than one inch wg.
3. Finish with one coat enamel applied to interior and exterior.
D. Bearings and Drives:
1. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway; protectively coated with lubricating oil.
3. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.
4. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
5. Lubrication: Extend lubrication fittings to outside of casing.

E. Accessories:
1. Inlet Bell: Bell mouth inlet fabricated of steel with flange.
2. Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0, with center pod as recommended by manufacturer.
3. Inlet Screens: Galvanized steel welded grid to fit inlet bell.
4. Access Doors: Shaped to conform to casing with quick opening latches and gaskets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.

C. Install flexible connections between fan inlet and discharge ductwork; refer to Section 23 0548. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Install fan restraining snubbers; refer to Section 23 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

E. Provide safety screen where inlet or outlet is exposed.

F. Pipe scroll drains to nearest floor drain.

G. Provide motorized dampers on discharge of exhaust fans and as indicated; refer to Section 23 3100.
H. Provide floor mounted axial fans with reinforced legs. Provide ceiling suspended units with support brackets bolted to casing flange.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Division 09 – Painting

C. Section 23 04 00 – General Conditions for Mechanical Trades

D. Section 23 33 00 – Air Duct Accessories.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating

B. AMCA 511 - Certified Ratings Program for Air Control Devices.

C. AMCA 540 – Debris Impact Resistance

D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.

E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.


I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

1.04 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Project Record Documents: Record actual locations of all air outlets and inlets.

C. Project Record Documents: Once the final Testing, Adjusting & Balancing Report is approved, record all typed airflow values on the as-built drawings.

D. Test Reports: Rating of air outlet and inlet performance.

E. Manufacturer’s Certificate: Certify products meet or exceed specified requirements

1.05 CLOSEOUT SUBMITTALS
A. Project Record Documents: Record actual locations of air outlets and inlets.

1.06 QUALITY ASSURANCE
A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. AMCA 540 – Debris Impact Resistance


E. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

F. Maintain two copies of each document on site.

1.07 PRE-INSTALLATION MEETINGS
A. Convene minimum one week prior to commencing work of this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. The following list of manufacturers applies to all air terminal units unless otherwise noted in sections below.
   1. Price Industries
   2. Titus
   3. Krueger
   4. Nailor Industries
   5. Anemostat

AIR OUTLETS AND INLETS
23 37 00 - 2
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Comment [AS1]: Do we want samples, I thought no.
2.02 ROUND CEILING DIFFUSERS

A. Type: Round, adjustable pattern, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with directional baffles where indicated. Diffuser collar shall project not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.

B. Fabrication: Steel with baked enamel finish.

C. Color: As selected by Architect from manufacturer's standard range.

D. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core, square, adjustable pattern, stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered, and diffuser to discharge air in 360 degree, one way, two way, three way, four way, and pattern with directional baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As selected by Architect from manufacturer's standard range.

F. Accessories: Refer to schedule.

2.04 CEILING SLOT DIFFUSERS

A. Type: Continuous wide slot, with adjustable vanes for left, right, or vertical discharge, refer to schedule

B. Fabrication: Aluminum extrusions with factory clear lacquer finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Frame: Refer to schedule.

E. Plenum: Integral, galvanized steel, insulated.

2.05 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

B. Frame: Refer to schedule.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As selected by Architect from manufacturer's standard range.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.06 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Frame: Refer to schedule.

B. Fabrication: Steel with 20 gage, 0.0359 inch minimum frames and 22 gage, 0.0299 inch minimum blades, steel and aluminum with 20 gage, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

E. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.07 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

G. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 1 - Administrative Requirements: Coordination and project conditions.
B. Verify inlet and outlet locations.

C. Verify ceiling, wall systems are ready for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly. Refer to Section 23 33 00.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09.

3.03 AIR OUTLET AND INLET SCHEDULE

A. Refer to contract drawings/plans.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Finned tube radiation.
   2. Radiant ceiling panels.

B. Related Sections:
   1. Section 23 04 00 – General Conditions for Mechanical Trades
   2. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   3. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
   4. Section 23 21 13 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, and drain piping to units specified by this section.
   5. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
   6. Section 23 22 13 - Steam and Condensate Heating Piping: Execution requirements for connection of steam supply and steam condensate return piping to units specified by this section.
   7. Section 23 22 16 - Steam and Condensate Piping Specialties: Product requirements for steam piping specialties for placement by this section.
   8. Section 23 23 00 - Refrigerant Piping: Execution requirements for connection of refrigerant piping to units specified by this section.
   9. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ducts specified by this section.
  10. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

B. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
B. Shop Drawings: Indicate cross sections of cabinets, grille, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

B. Installer: Company specializing in performing Work of this section with minimum three years [documented] experience [approved by manufacturer].

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.
1.09 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 PRODUCTS

2.01 FINNED TUBE RADIATION

A. Manufacturers:
   1. Rittling
   2. Vulcan
   3. Sterling
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Heating Elements: 3/4 inch ID seamless copper tubing, mechanically expanded into evenly spaced aluminum fins, suitable for soldered fittings.

C. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

D. Enclosures: 0.0478 inch thick steel up to 18 inches in height, 0.598 inch steel over 18 inches in height, with easily jointed components for wall to wall installation. Support rigidly, on wall or floor mounted brackets [at least 3 feet on center maximum].


F. Access Doors: For otherwise inaccessible valves, furnish factory-made permanently hinged access doors, 6 x 7 inch minimum size, integral with cabinet.

G. Capacity: As scheduled.

2.02 HYDRONIC RADIANT HEATERS

A. Manufacturers:
   1. TWA.
   2. Rittling
   3. Air-Tite
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Ceiling Panels: Constructed of modular 24” wide aluminum extrusions with interlocking edges to lengths indicated on plans.

C. Pipe Coil: 6 inch spacing module to incorporate extruded void into continuous ½ inch copper pipe is rolled and thermally bonded.
PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Verify ductwork is ready for installation.

E. Verify concealed blocking and supports are in place and connections are correctly located.

3.02 INSTALLATION

A. Hydronic Radiant Panels: Install with shut-off valve on supply piping and lockshield balancing valve on return piping.

3.03 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION
PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. This section applies to certain sections of Division 08 “Openings”, Division 11 “Equipment”, Division 12 “Furnishings”, Division 21 “Fire Protection”, Division 22 “Plumbing”, Division 23 “Mechanical”, Division 27 “Communications”, Division 28 “Electronic safety and Security”, Division 33 “Utilities” and this section applies to all sections of Division 26, “Electrical" of this project specification unless specified otherwise in the individual sections.

C. The Drawings of other trades Architectural, Structural, Landscape, Civil, Mechanical, Fire Protection and Plumbing, Food Service, Communications, and Electronic Safety and Security shall be examined for coordination and familiarity of work with other Contractors. Any duplication or omission of provisions in this project should be brought to the attention of the Owners prior to Bidding.

D. The drawings of equipment suppliers shall be examined for coordination and familiarity of work with Owner’s equipment suppliers.

1.02 DESCRIPTION

A. The General Conditions and Supplementary General Conditions are a part of this Division and are to be considered a part of this Contract.

B. Where items of the General Conditions and Supplementary General Conditions are repeated in other Sections of the Specifications, it is merely intended to qualify or to call particular attention to them. It is not intended that any other parts of the General Conditions and Supplementary General Conditions shall be assumed to be omitted if not repeated therein. This Section applies equally and specifically to all Contractors supplying labor and/or equipment and/or materials as required under each Section of this Division, (Division 27 and Division 28). Where conflicts exist between the drawings and the specifications or between this section of the specifications and other sections, the more stringent or higher cost option shall apply.

C. It is the intent of this Section of the Specifications to establish a standard of quality and performance characteristics for basic materials and installation methods used in building electrical (communications and electronic safety and security) systems.
1.03 INTENT

A. This contract is for all labor, materials and equipment required for installation. The system shall be complete and finished in all respects, tested and ready for operation. Work shall include calibration of equipment with factory settings. All materials, equipment and apparatus shall be new and of first class quality.

B. Any apparatus, appliance, material or work not shown on drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation as determined by good trade practice even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without any additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Owner and Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section has included the cost of all required items for the accepted, satisfactory functioning of the entire system without extra compensation.

E. Location of all existing systems and equipment shown on floor plans is based on the best available information. The Contractor shall verify all dimensions and locations of existing systems and equipment in the field and adjust as necessary.

F. Certain items of existing equipment may be indicated for removal or relocation. Items noted for removal shall be disconnected and turned over to the Owner or disposed of by the Contractor if the Owner so requests. If instructed to dispose of items, the Contractor shall remove the items from the premises and dispose of them in a safe, legal and responsible manner and location. Items noted for relocation are intended for reuse in another location as designated on the Drawings. It shall be the responsibility of the Contractor to remove the material from its present location, store the material in a safe place and reinstall the material in its new location. Questions regarding the suitability of the material or equipment shall be brought to the attention of the Owner and Engineer in writing.

G. Wherever a particular piece of equipment, device or material is specifically indicated on the Drawings by model number, type, series or other means, that specification shall take precedence over equipment or materials specified herein. For example: If a particular switch is specified on the Drawings, its specification takes precedence over switch specified herein.
1.04 DEFINITIONS

A. Word “Subcontractor” means specifically the subcontractor working under this Division. Other Contractors are specifically designated “Plumbing Subcontractor”, “General Contractor” and so on. Note: Take care to ascertain limits of responsibility for connecting equipment which requires connections by two or more trades.

B. Word “install” shall mean set in place complete with all mounting facilities and connections as necessary ready for normal use or service.

C. Words “furnish” or “supply” shall mean purchase, deliver to, and off-load at the job site, all ready to be installed including where appropriate all necessary interim storage and protection.

D. Word “provide” shall mean furnish (or supply) and install as necessary.

E. Word “finished” refers to all rooms and areas scheduled to be painted in Room Finish Schedule on the drawings. All rooms and areas not covered in Schedule, including underground tunnels and areas above ceilings shall be considered not finished, unless otherwise noted.

F. No Exceptions Taken – reviewed and determined to be in general conformance with contract documents.

G. Words “approved equal” mean any product which in the opinion of the Engineer is equal in quality, arrangement, appearance, and performance to the product specified.

H. Word “wiring” shall mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.

I. Word “product” shall mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.

J. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions."

K. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

L. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.
M. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

N. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

O. Remove: The term “remove” means “to disconnect from its present position, remove from the premises and to dispose of in a legal manner.”

P. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

Q. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.05 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Consult the Architectural Drawings and Details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the Architect. (Do not scale the drawings)

B. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; where space conditions appear inadequate, Owner and Engineer shall be notified before proceeding with installations.

C. The Owner may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and/or for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, higher rating, or higher value shall be included in the Contract price. The Owner and Engineer shall decide on the item and the manner in which the work shall be installed.

1.06 SURVEYS AND MEASUREMENTS

A. Before submitting his Bid, the Contractors shall visit the site and become thoroughly familiar with all existing conditions under which his work will be installed. This Contract includes all modifications of existing systems required for the installation of new equipment. This Contract includes all necessary offsets, transitions and modifications required to install all new equipment in existing spaces. All new and existing equipment and systems shall be fully operational under this Contract before
the job is considered complete. The Contractors shall be held responsible for any assumptions he makes, any omissions or errors he makes as a result of his failure to become fully familiar with the existing conditions at the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or which interfere with the intent of the Drawings and Specifications, the Engineer will be notified and work will not proceed until instructions from the Engineer are received.

1.07 CODES AND STANDARDS

A. Reference Standard Compliance
   1. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories Inc. (UL), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance.
   2. Independent Testing Organization Certificate: In lieu of the label or listing, indicated above submit a certificate from an independent testing organization, competent to perform testing, and approved by the engineer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

B. The Following Codes and Standards for the state and local jurisdiction where the project is located as listed below apply to all electrical work. Wherever Codes and/or Standards are mentioned in these Specifications, the latest applicable edition or revision shall be followed:
   Connecticut State Building Code Including all Supplements
   Connecticut State Fire Safety Code Including all Supplements
   School Construction Standards and Guidelines
   The International Building Code
   The International Mechanical Code
   The International Plumbing Code
   NFPA 70, the National Electrical Code
   NFPA 101, the Life Safety Code
   NECA - 1 Standard for Good Workmanship in Electrical Construction
   International Energy Conservation Code
C. The following Standards shall be used where referenced by the following abbreviations:
   - AIA: American Institute of Architects
   - ANSI: American National Standards Institute
   - ASME: American Society of Mechanical Engineers
   - ASTM: American Society of Testing and Materials
   - EPA: Environmental Protection Agency
   - FM: Factory Mutual
   - FSSC: Federal Specification
   - IEEE: Institute of Electrical and Electronics Engineers
   - NBS: National Bureau of Standards
   - NECA: National Electrical Contractors Association
   - NEMA: National Electrical Manufacturers Association
   - NFPA: National Fire Protection Association
   - NSC: National Safety Council
   - OSHA: Occupational Safety and Health Administration
   - UL: Underwriters’ Laboratories

D. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and the requirements of all Governmental departments having jurisdiction.

E. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether shown on Drawings and/or specified or not.

1.08 PERMITS AND FEES

   A. The Contractor shall give all necessary notices, obtain all permits; and pay all Government and State sales taxes and fees where applicable, and other costs, file all necessary Drawings, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspection for his work, and deliver a copy to the Owner and Engineer before request for acceptance and final payment for the work.

1.09 EQUIPMENT EQUIVALENTS AND SUBSTITUTIONS

   A. Certain manufacturers of material, apparatus or appliances are indicated in the drawings and specifications for this project. These items have been used as the basis of design, and as a convenience in fixing the minimum standard of workmanship, finish and design that is required. If the Contractors uses an “approved equal” alternative to the basis of design, and if the features of that alternative have an impact on other components of the Project, the Contractor shall include the necessary adjustments in those components, whether for architectural, structural, mechanical, electrical, fire protection, or any other elements, plus any adjustments for difference in performance.
B. Where one name only is used and is followed by the words “or approved equal”, the Contractor must use the item named or he is required to apply for a substitution. Where one name only is used, the Contractor must use that item named.

C. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be submitted for Architect and Engineer review.

D. Where the Contractor proposes to use an item that is different from the basis of design in the Drawings and specifications, and that will require the redesign of the structure, partitions, foundations, piping, wiring or any other component of the mechanical, electrical, or architectural layout, the Contractor shall provide the necessary redesign of those components.

E. Where the Contractor proposes to deviate (provide an equivalent or request for substitution) from the basis of design scheduled equipment or materials as hereinafter specified or shown on the drawings, they are required to submit a requested for substitution in writing. The Contractor shall state in their request whether it is a substitution, equivalent or a non approved equivalent to that specified and the amount of credit or extra cost involved. A copy of said request shall be included in the Base Bid with manufacturer’s equipment cuts. The Base Bid shall be based on using the materials and equipment as specified with no exceptions.

F. If an alternative or substitute item results in a difference in quantity and arrangement of piping, ductwork, valves, pumps, insulation, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such additional equipment required by the system, at no additional cost to the Owner including any costs added to other trades due to the equivalent change from the basis of design detailed in the drawings or included within the specifications.

G. Equipment, material or devices submitted for review as an “equivalent” shall meet the following requirements:
   1. The equivalent shall have the same construction features such as, but not limited to:
      a. Material thickness, gauge, weight, density, etc.
      b. Welded, riveted, bolted, etc., construction
      c. Finish, undercoating, corrosion protection
   2. The equivalent shall perform with the same or better operating efficiency.
   3. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
   4. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL or NEMA labels.

H. Equipment, material or devices submitted for review as a “substitution” shall meet the following requirements:
1. Substitution Request Submittal: Requests for substitution will be considered if received in writing 14 days before the bid date. Requests received later than 14 days before the bid date may be considered or rejected at the discretion of the Engineer/Owner. Once the Contractor submits a complete request for substitution as determined by the engineer, the engineer reserves the right to request the time necessary to evaluate the request for substitution and review it with the Owner.

2. Submit three (3) copies of each request for substitution for consideration.

3. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
   a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   f. Cost information, including a proposal of the net change, if any in the Contract Sum.
   g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
   h. Engineer's Action: Within one week of receipt of the request for substitution, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of a product substitution will be in the form of an Addendum.
   i. Other Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the Engineer;
otherwise requests will be returned without action except to record noncompliance with these requirements.

1) The request is directly related to an "or equal" clause or similar language in the Contract Documents.
2) The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
3) A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

1.10 SUBMITTAL PROCEDURES

A. Provide Submittals in accordance with the requirements of Division 1 and as indicated in the following.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
   1. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Engineer will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
   2. If an intermediate submittal is necessary, process the same as the initial submittal.
   3. Allow two weeks for reprocessing each submittal.
   4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.  
   1. Include the following information on the label for processing and recording action taken.  
      a. Project name.  
      b. Date.  
      c. Name and address of Engineer.  
      d. Name and address of Contractor.  
      e. Name and address of subcontractor.  
      f. Name and address of supplier.  
      g. Name of manufacturer.  
      h. Number and title of appropriate Specification Section.  
      i. Drawing number and detail references, as appropriate.  

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor’s certification that information complies with Contract Document requirements.  

F. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor’s responsibility.  

G. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken.  

1.11 SHOP DRAWINGS  

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.  

B. The Contractor shall submit for review detailed shop drawings of all equipment and material specified in each section and coordinated ductwork layouts. No material or equipment may be delivered to the job site or installed until the Contractor has received shop drawings for the particular material or equipment which have been properly reviewed. Shop drawings shall be submitted within 60 days after award of Contract before any material or equipment is purchased. The Contractor shall submit for review copies of all shop drawings to be incorporated in the Electrical Contract. Refer to the General Conditions and Supplementary General Conditions.
for the quantity of copies required for submission. Where quantities are not specified, provide seven (7) copies for review.

C. Provide shop drawings for all devices specified under equipment specifications for all systems including fire alarm, switchgear, clock, lighting, etc., or where called for elsewhere in the Specifications, or where scheduled on the drawings, or where called out on the drawings. Shop drawings shall include manufacturers’ names, catalog numbers, cuts, diagrams, dimensions, identification of products and materials included, compliance with specified standards, notation of coordination requirements, notation of dimensions established by field measurement and other such descriptive data as may be required to identify and accept the equipment. A complete list in each category (example: all fixtures) of all shop drawings, performance cuts, material lists, etc., shall be submitted to the Engineer at one time. No consideration will be given to a partial shop drawing submittal.

D. Submittals shall be marked with the trade involved, i.e., Electrical, HVAC, Plumbing, Fire Protection, etc. when the submittal could involve more than one trade.

E. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment or material being submitted.

F. Failure to submit shop drawings in ample time for review shall not entitle the Contractor to an extension of Contract time. No claim for extension by reason of such default will be allowed, nor shall the Contractor be entitled to purchase, furnish and/or install equipment which has not been reviewed by the Engineer.

G. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

H. Acceptance rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are reviewed, review does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings.

I. Acceptance of shop drawings shall not apply to quantity nor relieve Contractor of his responsibility to comply with intent of Drawings and Specifications.

J. Acceptance of shop drawings is final and no further changes will be allowed without the written consent of the Engineer.

K. Acceptance of shop drawings does not relieve the Contractor from submitting, coordinating and implementing schedules, forms, worksheets and similar as required for owner/operator input and approval as specified herein and required for proper system operation.
L. Shop drawing submittal sheets which may show items that are not being furnished shall have those items crossed off to clearly indicate which items will be furnished.

M. Bidders shall not rely on any verbal clarification of the Drawings and/or Specifications. Any questions shall be referred to the Engineer in writing at least five (5) working days prior to Bidding to allow for issuance of an Addendum.

N. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.12 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 Section "PROJECT COORDINATION," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of light fixtures, panelboards, conduits, cabinets, etc. Include the following:
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, including NEC requirements and space for equipment disassembly required for periodic maintenance.
4. Equipment connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and locations of required concrete pads and bases.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. Electronic copies of the MEP floor plans are available to use as a basis for preparing coordination drawings and can be provided by the Engineer. If the Contractor elects to obtain the Engineers electronic files an Electronic File Release Form must be submitted. This form must be signed by the Contractor, Owner, and Architect. Upon receipt of a signed copy of the Electronic File Release Form, the Engineer will provide copies of the electronic files for the Contractor's use. A copy of the Electronic File Release Form is appended to the end of this specification section.
1.13 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, etc., required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference with the work of other trades. In general, ductwork, heating, condenser, chilled water piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, the Contractors will cooperate in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or Sections or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

E. Where work is installed prior to preparation and approval of the Coordination Drawings or in conflict with the approved Coordination drawings and if so directed in other Sections, the Contractor indicated shall prepare composite working drawings and sections clearly showing how the work is to be installed in relation to the work of other trades, at no extra charge to the Owner.

1.14 WORKMANSHIP

A. Service Support: The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Modification of References: In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

C. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work together with all skilled workmen, journeymen, electricians, helpers and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

D. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and
in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

E. All labor for installation of electrical systems shall be performed by experienced, skilled tradesmen under the supervision of a licensed journeyman foreman. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, workmanlike manner. The Engineer reserves the right to reject any work which, in his opinion, has been installed in a substandard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra cost to the Owner.

1.15 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Owner.

B. The Engineer and the Owner shall be notified in writing of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.16 TEMPORARY UTILITIES

A. General: Provide new materials and equipment; if acceptable to the Engineer, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

C. First Aid Supplies: Comply with governing regulations.

D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

E. Provide temporary lighting in all areas, throughout construction activities.

1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.
2. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
   a. Except where overhead service must be used, install electric power service underground.
   b. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

3. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period.

F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

G. Termination and Removal: Unless the Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

1.17 PROJECT PHASING

A. Work under each Section shall include all necessary temporary connections, equipment, conduit, wiring, fire alarm equipment and testing, lighting and emergency lighting, fire stopping, connection of necessary mechanical equipment, labor, and material as necessary to accommodate the phasing of Construction as developed by the General Contractor or Construction Manager and approved by the Owner. All existing systems that pass-thru an area of the building or are required to be maintained in a phased fashion during construction shall remain operational during all phases of construction. No extra compensation shall be granted the Contractor for work required to maintain existing systems operational or to accommodate the construction phasing of the project.
1.18 PROTECTION OF MATERIALS AND EQUIPMENT

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workmen and shall include making good all damage thus caused.

B. The Contractor shall be responsible for work and equipment until the facility has been accepted by the Owner. Protect work against theft, injury or damage and carefully store material and equipment received on site which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and completely connecting equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the equipment and fixtures which are missing or damaged.

D. Equipment and material stored on the job site shall be protected from the weather, vehicles, dirt and/or damage by workmen or machinery. Insure that all electrical or absorbent equipment or material is protected from moisture during storage.

1.19 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer or specified in the contract documents, a factory-trained service representative shall inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service representative shall supervise the initial operation of the equipment and instruct the personnel responsible for operation and maintenance of the equipment. The service representative shall notify the Contractor in writing that the equipment was installed according to manufacturer’s recommendations and is operating as intended by the manufacturer. Factory start-up reports shall be included in the operation and maintenance manuals under the appropriate equipment section.

1.20 CLEANING

A. The Contractor shall thoroughly clean all equipment of all foreign substances, oils, dust, dirt, etc., inside and out before final acceptance by the Engineer.

B. If any part of a system should be stopped or damaged by any foreign matter after being placed in operation, the system shall be disconnected, cleaned and reconnected wherever necessary to locate and/or remove obstructions. Any work
damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. During the course of construction, all conduits shall be capped in an acceptable manner to insure adequate protection against the entrance of foreign matter.

D. Upon completion of all work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work.

E. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.
2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces and panelboard interiors.

F. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove and dispose of ALL waste materials, packaging material, skids etc. from the site and dispose of in a lawful manner in accordance with municipal, state and federal regulations.

G. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

1.21 OPERATING AND MAINTENANCE

A. Upon completion of all work and tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or the Owner’s representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least seven (7) day notice to the Owner and the Engineer in advance of this period.

B. The Contractor shall include the maintenance schedule for the principal items of equipment furnished under this Division.
C. The Contractor shall physically demonstrate procedures for all routine maintenance of all equipment furnished under each respective Section to assure accessibility to all devices.

D. An authorized manufacturer’s representative shall attest in writing that the equipment has been properly installed prior to startup of any major equipment. At a minimum, the following equipment will require this inspection: emergency generator, fire alarm system, nurse call system, paging systems, etc. These letters will be bound into the operating and maintenance books.

E. Refer to individual trade Sections for any other particular requirements related to operating instructions.

F. Demonstration shall be recorded on CD Rom with two (2) discs turned over to the Owner.

1.22 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with the requirements of Division 1 and as follows. The Contractor shall prepare six (6) copies of a complete maintenance and operating instructions manual, bound in booklet form. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.

B. Manual shall include the following:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Emergency instructions.
6. Spare parts list.
8. Wiring diagrams.
9. Recommended "turn around" cycles.
10. Inspection procedures.
11. Shop Drawings and Product Data.
12. Equipment start-up reports.
C. Include in the manual, a tabulated equipment schedule for all equipment. Schedule shall include pertinent data such as: make, model number, serial number, voltage, normal operating current, belt size, filter quantities and sizes, bearing number, etc. Schedule shall include maintenance to be done and frequency.

D. Maintenance and instruction manuals shall be submitted to the Owner at the same time as the seven (7) day notice is given prior to the instruction period.

1.23 DEMONSTRATION AND TRAINING

A. Training of Owner Personnel:
   1. Contractor shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.
   2. Training shall be of sufficient length to allow the trained staff to train their peers and to demonstrate the training sessions were effective.
   3. Training as required throughout these specifications shall be videotaped. Hire the services of a Professional Videographer. Videotaping via handheld devices is not acceptable.
   4. Duration of Training: Electrical Contractor shall provide training on each piece of equipment according to the following schedule:

<table>
<thead>
<tr>
<th>System</th>
<th>Minimum Training Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIVISION 26 – ELECTRICAL</td>
<td></td>
</tr>
<tr>
<td>Lighting Control Devices</td>
<td>4</td>
</tr>
<tr>
<td>Emergency Shutoff Management Systems</td>
<td>4</td>
</tr>
<tr>
<td>DIVISION 27 – COMMUNICATIONS</td>
<td></td>
</tr>
<tr>
<td>Audio-Video Systems</td>
<td>8</td>
</tr>
<tr>
<td>Public Address Systems</td>
<td>4</td>
</tr>
<tr>
<td>Clock Systems</td>
<td>4</td>
</tr>
<tr>
<td>DIVISION 28 – ELECTRONIC SAFETY &amp; SECURITY</td>
<td></td>
</tr>
<tr>
<td>Fire Detection and Alarm</td>
<td>4</td>
</tr>
</tbody>
</table>

B. Training shall be provided for fundamental preventative maintenance, service, cleaning, and troubleshooting. All training materials (agenda, hand-outs, etc.) shall be submitted to the Owner for review and approval at least two weeks in advance of scheduled training. Training materials shall be digital (x5 copies via thumb drive) and hard copy (x2 copies) format.
1.24 ACCEPTANCES

A. The equipment, materials, workmanship, design and arrangement of all work installed under the Electrical Sections shall be subject to the review of the Engineer.

B. Within 30 days after the awarding of a Contract, the Electrical Contractor shall submit to the Engineer, for review, a list of manufacturers of equipment proposed for the work under the Electrical Sections. The intent to use the exact makes specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Owner and Engineer, in writing, within 30 days of the awarding of the Contract. In such instances, deviations may be made pending acceptance by the Engineer or the Owner’s representative.

D. Where any specific material, process or method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Electrical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for review. Equipment characteristics are to be used as mandatory requirements where the Contractor proposes to use an acceptable equivalent.

E. If material or equipment is installed before it is reviewed and/or approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of, or standard of quality implied by, the Drawings and Specifications.

F. Failure on the part of the Engineer to reject shop drawings or to reject work in progress shall not be interpreted as acceptance of work not in conformance with the Drawings and/or Specifications. Work not in conformance with the Drawings and/or Specifications shall be corrected whenever it is discovered.

1.25 RECORD DRAWINGS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer’s reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line whiteprints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
5. Final record documents shall be prepared in the latest AutoCAD version and digital media for all drawings and a clean set of reproducible paper copies shall be turned over to the Owner at the completion of the work.

1.26 WARRANTIES AND BONDS

A. The following general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties are to be included:
   1. General close-out requirements included in Section "Project Close-out."
   2. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

C. Separate Prime Contracts: Each prime Contractor is responsible for warranties related to its own Contract.

1.27 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

G. Submit written warranties to the Engineer prior to the date certified for Substantial Completion. If the Engineer’s Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

H. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

I. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Engineer for approval prior to final execution.
   1. Refer to individual Sections of Divisions 2 through [16][50] for specific content requirements, and particular requirements for submittal of special warranties.

J. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

K. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2” by 11” paper.
   1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.28 GUARANTEES

A. The Contractor shall guarantee all material and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by Owner. During this guarantee period, all defects developing through faulty equipment, materials or workmanship shall be corrected or replaced immediately by this Contractor without expense to the Owner. Such repairs or replacements shall be made to the Engineers satisfaction.

B. Contractor shall provide name, address, and phone number of all contractors and subcontractors and associated equipment they provided

1.29 PROJECT CLOSE-OUT

A. Contractor shall submit annual maintenance proposal to the Architect/Engineer for review and approval as part of the close out documents.

B. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

C. Deliver tools, spare parts, extra stock, and similar items.

D. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

E. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

F. Inspection Procedures: On receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

END OF SECTION
Electronic File Release Form

DELIVERY OF ELECTRONIC FILES FOR: ________________________________

Project Name

In accepting and utilizing any drawings or other data on any form of electronic media generated and provided by the Design Professional, the Client covenants and agrees that all such drawings and data are instruments of service of the Design Professional, who shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.

The Client further agrees not to use these drawings and data, in whole or in part, for any purpose or project other than the project which is the subject of this Agreement. The Client agrees to waive all claims against the Design Professional resulting in any way from any unauthorized changes or reuse of the drawings and data for any other project by anyone other than the Design Professional.

In addition, the Client agrees, to the fullest extent permitted by law, to indemnify and hold the Design Professional harmless from any damage, liability or cost, including reasonable attorneys’ fees and costs of defense, arising from any changes made by anyone other than the Design Professional or from any reuse of the drawings and data without the prior written consent of the Design Professional.

Under no circumstances shall transfer of the drawings and other instruments of service on electronic media for use by the Client be deemed a sale by the Design Professional, and the Design Professional makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

_____________________________________________ ________________________
Client’s Signature Date

_____________________________________________ Company - Title

_____________________________________________ Architects’ Signature Date

_____________________________________________ Firm - Title

_____________________________________________ Owner’s Signature Date

_____________________________________________ Company - Title
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prior to beginning work, test the existing systems as appropriate and document all deficiencies affecting the work under this contract to the architect and owner. Provide a cost proposal for recommended solutions. Do not proceed with the corrective work until authorized by the owner or their appointed representatives.

B. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements.

B. Section 26 04 00 – General Conditions for Electrical Trades.

C. Division 02 - Existing Conditions

1.03 SUBMITTALS

A. Division 01 – General Requirements.

B. Section 26 04 00 – General Conditions for Electrical Trades.

C. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. It is the Contractor’s responsibility to modify the existing Fire Alarm, Telecommunications, Paging, Intercom and Master Clock, and Security systems in a phased fashion and be maintained outside of the phased area of work. Maintain operation of the existing systems during phased demolition. Devices are to be
GRAHBY MEMORIAL HIGH SCHOOL
GRANBY, CT

removed back to the next device outside of the area of work. Extend circuits with wiring to match existing as required to maintain continuity of circuits upstream and downstream of the work affected by demolition. Protect existing devices during construction. Take devices off-line if necessary, coordinate bypassing and reactivation of the devices with the Owner.

B. Demolition is to be performed in a selective, phased fashion and performed to maintain existing systems in areas remaining operational. It is the contractor’s responsibility to coordinate disruption of systems or circuits and to investigate all circuiting and devices scheduled for removal. Provide temporary measures to maintain existing systems and circuits as required. Refer to phasing plans and coordinate all phasing work with the CM/GC and Owner.

C. Verify field measurements and circuiting arrangements are as shown on Drawings.

D. Verify that abandoned wiring and equipment serve only abandoned facilities.

E. Demolition drawings are based on limited field observation and existing record documents where available.

F. Report discrepancies to Architect/Engineer before disturbing existing installation.

G. Beginning of demolition means installer accepts existing conditions.

H. Contractor shall modify existing circuits, when existing devices are removed, as required to maintain circuit continuity.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company and the Owner.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Phased Construction: Provide temporary equipment, wiring, conduit, labor and materials as required to maintain operation of existing systems during all phases of construction.

E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 72 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.
F. Existing Fire Alarm System: Maintain existing system in service until new system is complete and accepted by the Owner and Local Authorities. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner and local authorities before partially or completely disabling system.
   2. Make notifications at least 72 hours in advance.
   3. Make temporary connections to maintain service in areas adjacent to work area.
   4. Provide protective coverings for all inactive devices until testing and final acceptance and demolition.

G. Existing Telecommunications Systems: Maintain existing systems in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Notify Owner at least 72 hours before partially or completely disabling system.
   2. Notify telephone utility company at least 72 hours before partially or completely disabling system.
   3. Make temporary connections to maintain service in areas adjacent to work area.

H. Existing Public Address, Master Clock and Security Systems: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
   1. Obtain permission from Owner at least 72 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.
D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Division 01 - General Requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires indicated for reuse within the project for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, drivers, and broken electrical parts.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
A. Section includes electrical connections to equipment.

1.02 RELATED SECTIONS
A. Division 01 – General Requirements
B. Section 260400 – General Conditions for Electrical Trades.

1.03 REFERENCE STANDARDS
A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.04 SUBMITTALS
A. See Division 01 - General Requirements
B. Product Data: Submit device manufacturer’s catalog information showing dimensions, configurations, and construction.
C. Provide manufacturer’s installation instructions.

1.05 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

1.06 CLOSEOUT SUBMITTALS
A. See Division 01- General Requirements
B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.07 COORDINATION
A. See Division 01 - General Requirements
B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer’s instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 ATTACHMENT PLUGS

A. Manufacturers:
   1. Hubbell.
   2. Leviton.
   3. Legrand / Pass & Seymour
   4. Substitutions: Division 01 - General Requirements.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration to outlet furnished for equipment.

D. Rating: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

2.02 FLEXIBLE CORD

A. Manufacturers:
   1. General Cable.
   2. Southwire Company.
   3. Hubbell Incorporated.
   4. Substitutions: Division 01 - General Requirements.

B. Cord Construction:
   1. Type [SO] [SJO] [_______] multi-conductor flexible cord with identified neutral and equipment grounding conductor, [suitable for use in damp locations.]
   2. Rating: 600V [300V], amperage to match full load or MCA rating of equipment being served, sized per NFPA 70, Article 400.5.
   3. Conductor Identification:

C. Neutral:
   1. White or gray colored braid.
   2. Colored tracer in the braid.
   3. White, gray, or light blue insulation.
4. Ridges, grooves, or white stripes on the exterior of the cord.

D. Equipment Grounding Conductor:
   1. Continuous green color.
   2. Continuous identifying marker distinguishing it from the other conductors.

E. Connectors:
   1. Type: All steel fitting with gland nut, seal, and bushing for securing cable.
   2. Suitable for use for passing cord thru enclosure or bulkhead.
   3. Provide with suitable NEMA rating for application.

F. Strain Relief:
   1. Type: Aluminum fitting with galvanized steel mesh, duct-tight
   2. Suitable for size and type of flexible cord being used.

G. All drop cords shall use copper conductors. Size of conductors shall match the branch circuit serving the piece of equipment.

H. Provide receptacle at end of drop cord or hardwired connection to equipment as specified on drawings. Provide in-line GFCI protection of receptacles at the end of drop cord where GFCI is specified on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.02 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.03 INSTALLATION

A. Make conduit connections to equipment using flexible metal conduit. Use liquidtight flexible metal conduit with watertight connectors in damp or wet locations.
B. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

C. Provide receptacle outlet and plate to accommodate connection to attachment plug.

D. Provide flexible cord and cord-cap for field-supplied attachment plug. Coordinate exact requirements with equipment supplier.

E. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

G. Install terminal block jumpers to complete equipment wiring requirements.

H. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

I. Coolers and Freezers: Coordinate the location of openings in freezer and cooler walls, floor, and ceilings with equipment supplier. Seal openings.

J. Install conduit and wiring for interconnection of motorized door operator and motorized fire door control stations, safety devices and accessories to complete equipment wiring requirements.

K. Install conduit and wiring for interconnection of specialty equipment (motorized divider partitions, scoreboards, motorized backboards, shot clocks, motorized shades...etc.) control stations, safety devices and accessories to complete equipment wiring requirements.

L. Install conduit and wiring for interconnection of receptacles, lighting and switches furnished with equipment (fume hoods, food service equipment, furnishings...etc.).

M. Install conduit and wiring for interconnection of alarm initiating devices, control panels and annunciators furnished with equipment.

N. Install conduit and wiring for interconnection of power supplies furnished by other divisions.

O. Install conduit and wiring for interconnection of fire alarm initiating devices, control panels, motors, disconnect switches, and card access equipment and furnished with elevator equipment.

3.04 ADJUSTING

A. See Division 01 – General Requirements.
B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

3.05 EQUIPMENT CONNECTION SCHEDULE

A. Refer to drawings.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Metal-clad cable.
C. Wiring connectors.
D. Electrical tape.
E. Heat shrink tubing.
F. Oxide inhibiting compound.
G. Wire pulling lubricant.
H. Cable ties.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements.
B. Division 07 – Thermal and Moisture Protection.
C. Section 26 0501 – Electrical Demolition: Disconnection, removal, and/or extension of existing electrical conductors and cables.
D. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 28 3100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS


H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

I. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.


L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.


P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.


S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

T. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.
1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.
   3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer’s instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer’s instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted, unless noted otherwise.

D. Service entrance cable is not permitted, unless noted otherwise.

E. Armored cable is not permitted.

F. Metal-clad cable is permitted as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      1) Maximum Length: 6 feet.
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
      1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Feeders to panelboards.
      b. Life Safety or Critical Power.
c. Homeruns from first device, such as lighting fixture, MEP equipment, wiring device to panelboards.
d. Where not approved for use by the authority having jurisdiction.
e. Where exposed to view.
f. Where exposed to damage.
g. For damp, wet, or corrosive locations.
h. For isolated ground circuits, unless provided with an additional isolated/insulated grounding conductor.

G. Mineral Insulated Cable permitted as follows:
   1. Rated Feeders requiring a 2-hour protective rating.
   2. Fire Alarm and Control Circuits requiring survivability rating.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide conductors and cables with lead content less than 300 parts per million.

D. Provide new conductors and cables manufactured not more than one year prior to installation.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

F. Comply with NEMA WC 70.

G. Comply with FS A-A-59544 where applicable.

H. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

I. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

J. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

K. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

L. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

M. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
N. Conductor Material:
1. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, or ASTM B8 unless otherwise indicated.

O. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG minimum, and sized for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG minimum, and sized for voltage drop.
      3) 20 A, 277 V circuits longer than 150 feet: 10 AWG minimum, and sized for voltage drop.

2. Control Circuits: 14 AWG.

P. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

Q. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 480Y/277 V, 3 Phase, 4 Wire System:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral/Grounded: Gray.
   b. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   c. Equipment Ground, All Systems: Green.
   d. Travelers for 3-Way and 4-Way Switching: Pink.
   e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
   f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
   a. Cerro Wire LLC.
   b. Southwire Company
   c. General Cable Technologies
   d. Substitutions: See Section 01 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
   1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
   2. Aluminum Building Wire (only where specifically indicated): Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc.
   2. Encore Wire Corporation
   3. Southwire Company
   4. General Cable Technologies
   5. Substitutions: See Section 01 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Provide dedicated neutral conductor for each phase conductor where indicated or required.

H. Grounding: Full-size integral equipment grounding conductor.
1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Steel, interlocked tape.

J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
   1. Copper conductors 10 AWG and smaller: Install insulated spring wire connectors with plastic caps
   2. Copper Conductors Size 8 AWG: Install solderless pressure connectors with insulating covers
   3. Copper Conductors Size 6 AWG and larger: Install pressure connectors or split bolt connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
   5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   6. Aluminum Conductors: Use compression connectors for all connections.
   7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
   8. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M
      b. Ideal Industries, Inc.
      c. NSI Industries LLC.
      d. Ilsco
      e. Erico
      f. Substitutions: See Division 01 – General Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC.
      b. Ilsco
      c. Thomas & Betts Corporation
      d. Substitutions: See Division 01 – General Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy LLC.
      b. Ilsco
      c. Thomas & Betts Corporation
      d. Erico
      e. Substitutions: See Division 01 – General Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy LLC.
      b. Ilsco
      c. Thomas & Betts Corporation
      d. Substitutions: See Division 01 – General Requirements.

2.06 WIRING ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M
      b. Plymouth Rubber Europa
      c. Substitutions: See Division 01 – General Requirements.

   2. Vinyl Color Coding Electrical Tape: Integrially colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil;
resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

1. Manufacturers:
   a. 3M
   b. Burndy LLC.
   c. Thomas & Betts Corporation
   d. Substitutions: See Division 01 – General Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

1. Manufacturers:
   a. Burndy LLC.
   b. Ideal Industries, Inc.
   c. Ilsco
   d. Substitutions: See Division 01 – General Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

1. Manufacturers:
   a. 3M
   b. American Polywater Corporation
   c. Ideal Industries, Inc.
   d. Substitutions: See Division 01 – General Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.

1. Manufacturers:
   a. Burndy LLC.
   b. Substitutions: See Section 01 - Product Requirements.

2. Provide plenum rated cable ties.
PART 3 EXECUTION

3.01 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.

C. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.

D. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

E. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

3.02 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as shown on the drawings.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.03 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.04 INSTALLATION

A. Feeders and branch circuits shall be concealed in walls or ceilings, except in electrical rooms and other similar utility spaces.

B. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated and routing is not shown, determine exact routing required.
   3. Arrange circuiting to minimize splices.
4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted where indicated:
   a. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required accounting for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.


C. Install products in accordance with manufacturer's instructions.

D. Perform work in accordance with NECA 1 (general workmanship).

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

I. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

d. Secure at maximum interval of 5 ft.

e. Install parallel and perpendicular to building lines.

f. Bundle cables in common routes back to panelboards.

g. Secure from structure using suitable J-hooks or plenum rated cable ties.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

N. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Do not remove conductor strands to facilitate insertion into connector.

3. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.


5. Mechanical Connectors: Secure connections according to manufacturer’s recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer’s recommended tools and dies.

O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.

   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.

   b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.

2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.


P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Identify conductors and cables in accordance with Section 26 0553.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.05 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.
B. Connectors and conductors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements
B. Section 26 0400 – General Conditions for Electrical Trades
C. Section 26 0519 - Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 26 5100 - Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. NECA 1 - Standard for Good Workmanship in Electrical Construction.
C. NFPA 70 - National Electrical Code.
D. UL 467 - Grounding and Bonding Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.
B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for grounding and bonding system components.
C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
      a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
      b. Metal gas piping.
      c. Metal process piping.
   8. Provide bonding for metal building frame.
   9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
   10. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
   11. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.
B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0519:

1. Use insulated copper conductors unless otherwise indicated.
   a. Exceptions:
      1) Use bare copper conductors where installed underground in direct contact with earth.
      2) Use bare copper conductors where directly encased in concrete (not in raceway).

2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   a. Exceptions:
      1) Use mechanical connectors for connections to electrodes at ground access wells.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
   a. Exceptions:
      1) Use exothermic welded connections for connections to metal building frame.

4. Manufacturers - Mechanical and Compression Connectors:
   a. Advanced Lightning Technology (ALT)
   b. Burndy LLC.
   c. Harger Lightning & Grounding
   d. Thomas & Betts Corporation
   e. Substitutions: See Division 01 - General Requirements.

5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC.
   b. Cadweld, a brand of Erico International Corporation
   c. ThermOweld, a brand of Continental Industries, Inc. Substitutions: See Division 01 - General Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Install in accordance with IEEE 142.

E. Install grounding and bonding conductors concealed from view.

F. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

H. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

I. Permanently attach equipment and grounding conductors prior to energizing equipment.
J. Identify grounding and bonding system components in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for electrical equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements
B. Section 260400 – General Conditions for Electrical Trades
C. Section 260533 – Raceway and Boxes for Electrical Systems: Additional support and attachment requirements for conduits.
D. Section 265100 - Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

D. MFMA-4 - Metal Framing Standards Publication; 2004.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.
B. Coordination:
1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.
2. Coordinate the work with other trades and provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer’s instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer’s application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, fiberglass or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; zinc plated steel.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation
      b. Erico International Corporation
      c. O-Z/Gedney, a brand of Emerson Industrial Automation
      d. Thomas & Betts Corporation
      e. Substitutions: See Division 01 - General Requirements.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
a. Cooper Crouse-Hinds, a division of Eaton Corporation
b. Erico International Corporation
c. O-Z/Gedney, a brand of Emerson Industrial Automation
d. Thomas & Betts Corporation
e. Substitutions: See Division 01 - General Requirements.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
2. Channel Material:
   a. Indoor Dry Locations: Use galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
5. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Thomas & Betts Corporation
   c. Unistrut, a brand of Atkore International Inc.
   d. Substitutions: See Division 01 - General Requirements.
   e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Busway Supports: 1/2 inch diameter.
   c. Single Conduit up to 1 inch trade size: 1/4 inch diameter.
   d. Single Conduit larger than 1 inch trade size: 3/8 inch diameter.
   e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
   f. Outlet Boxes: 1/4 inch diameter.
   g. Luminaires: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Erico International Corporation
   c. PHP Systems/Design
   d. Unistrut, a brand of Atkore International Inc.
e. Substitutions: See Division 01 - General Requirements.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners may be used with:
   a. Permission by Architect.
   b. Permission by Structural Engineer.
   c. Use only threaded studs; do not use pins.
11. Hammer-driven anchors and fasteners are permitted as follows:
   a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
   b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   b. Channel Material: Use galvanized steel.
   c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
   d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
13. Manufacturers - Mechanical Anchors:
   a. Hilti, Inc.
   b. ITW Red Head, a division of Illinois Tool Works, Inc.
   c. Powers Fasteners, Inc.
   d. Simpson Strong-Tie Company Inc.
   e. Substitutions: See Division 01 - General Requirements.
14. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc.
   b. ITW Ramset, a division of Illinois Tool Works, Inc. Powers Fasteners, Inc.
   c. Simpson Strong-Tie Company Inc.
   d. Substitutions: See Division 01 - General Requirements.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Install conduit and raceway support and spacing in accordance with NEC.

H. Install multiple conduit runs on common hangers.

I. Anchors and Fasteners:
   1. Concrete Structural Elements: Provide precast inserts, expansion anchors.
   2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners.
   3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
   5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
   7. Wood Elements: Provide wood screws.

J. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above flush with top of recessed into and grouted flush with slab.

K. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

L. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners according to manufacturer's recommended torque settings.

O. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements, for additional requirements.
B. Inspect support and attachment components for damage and defects.
C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
D. Correct deficiencies and replace damaged or defective support and attachment components.
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SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Conduit Applications
2. General Requirements
4. Intermediate metal conduit (IMC)
5. Flexible metal conduit (FMC).
7. Electrical metallic tubing (EMT).
8. Rigid polyvinyl chloride (PVC) conduit.
9. Liquidtight flexible nonmetallic conduit (LFNC).
10. Non-metallic tubing
11. Surface metal raceway
12. Wireway
13. Boxes

B. Related Sections:
1. Section 260503 - Equipment Wiring Connections.
2. Section 260519 – Electrical Power Conductors and Cables.
3. Section 260526 - Grounding and Bonding for Electrical Systems.
5. Section 260534 - Floor Boxes for Electrical Systems.
7. Section 262726 - Wiring Devices.
8. Section 270533 - Raceway and Boxes for Communications Systems.

1.02 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);
D. NECA 1 - Standard for Good Workmanship in Electrical Construction;
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);
F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;

G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);

H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;

I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;

J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;

K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;

L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);

M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.


X. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.


AA. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.


1.03 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

B. Branch circuits shall be concealed in walls and above ceilings unless otherwise indicated on drawings. Do not route branch circuits in or under slab unless otherwise indicated. This shall also apply to homeruns back to panelboards. Adhere to the requirements within Part 2 of this Section for additional requirements.

C. Feeders shall be concealed in walls and above ceilings unless otherwise indicated on drawings. Do not route feeder circuits in or under slab unless otherwise indicated. Adhere to the requirements within Part 2 of this Section for additional requirements.

D. Electrical feeders shall be run above ceilings in conduit. Branch circuits shall be run above ceilings in conduit from panelboard to first device. After first device, branch circuits may be run with MC cable in concealed spaces as outlined in the specifications. Installation of feeders or branch circuits in or under concrete slab is not acceptable.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.
B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer’s Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer’s standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.
D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

1.08 COORDINATION

A. See Division 01 – General Requirements

B. Coordinate installation of outlet boxes for equipment connected under Section 260503.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

D. Electrical contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

C. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications listed below. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

1. Underground:
   a. Under Slab on Grade: Use schedule 40 rigid PVC conduit with galvanized steel rigid metal conduit sweeps. Provide cast metal boxes or nonmetallic handhole. Applications limited to:
      1) Panelboard feeders
      2) Floor boxes
      3) Free-standing equipment
b. Exterior, Within Trench: Use schedule 40 or schedule 80 rigid PVC conduit with galvanized steel rigid metal conduit sweeps. Provide cast metal boxes or nonmetallic handhole.

c. Exterior, Concrete Encased: Use Type EB rigid PVC conduit. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

2. Embedded Within Concrete:
   a. Within Slab on Grade: Floor box applications only.
   b. Within Slab Above Ground: Not permitted.
   c. Within Concrete Walls Above Ground: Use Type EB rigid PVC conduit. Provide flush mounted box rated for masonry applications.


5. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT) or MC cable (where allowed).

6. Interior, Damp or Wet Locations Provide:
   a. Electrical metallic tubing (EMT) with compression fittings
   b. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

7. Exposed, Interior dry locations: Use electrical metallic tubing (EMT)

8. Exposed, Exterior: Use galvanized steel rigid metal conduit


10. Connections to Vibrating Equipment:
    a. Dry Locations: Use flexible metal conduit or MC Cable.
    b. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
    c. Maximum Length: 6 feet unless otherwise indicated.
    d. Vibrating equipment includes, but is not limited to:
        1) Transformers.
        2) Motors.
        3) Pumps.
        4) Fans.

11. Exposed Dry Finished Locations: Provide surface metal raceway and fittings. Unless specified on drawings, requires design team approval for use of surface metal raceway in finished locations. Coordinate all vertical runs of surface raceway with the architect prior to installation.

2.02 GENERAL REQUIREMENTS

A. Fittings for Grounding and Bonding: Also comply with Section 260526.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:
   3. Control Circuits: 1/2 inch trade size.
   5. Underground, Interior: 1 inch trade size.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

   A. Manufacturers:
      1. Allied Tube and Conduit.
      2. Western Tube and Conduit.
      3. Wheatland Tube Company.
      4. Substitutions: See Division 01 – General Requirements.

   B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

   C. Fittings:
      1. Manufacturers:
         a. Bridgeport Fittings Inc.
         b. O-Z/Gedney.
         c. Thomas & Betts Corporation.
         d. Substitutions: See Division 01 – General Requirements
      2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
      3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
      4. Material: Use steel or malleable iron.
      5. Do not use die cast zinc fittings.
      6. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

   A. Manufacturers:
      1. Allied Tube and Conduit.
      2. Western Tube and Conduit.
      3. Wheatland Tube Company.
      4. Substitutions: See Division 01 – General Requirements.

   B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

   C. Fittings:
1. Manufacturers:
   a. Bridgeport Fittings Inc
   b. O-Z/Gedney, a brand of Emerson Industrial Automation
   c. Thomas & Betts Corporation
   d. Substitutions: See Division 01 – General Requirements

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

   a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use threaded type or compression fittings only.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. Carlon Electrical Products.
   2. Allied Tube and Conduit.
   3. AFC Cable Systems, Inc
   4. Substitutions: See Division 01 – General Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
      b. O-Z/Gedney, a brand of Emerson Industrial Automation
      c. Thomas & Betts Corporation
      d. Substitutions: See Division 01 – General Requirements

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. Carlon Electrical Products.
   2. Allied Tube and Conduit.
   3. AFC Cable Systems, Inc
   4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube and Conduit.
   2. Western Tube and Conduit.
   3. Wheatland Tube Company.
   4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc
   2. Carlon, a brand of Thomas & Betts Corporation
   3. JM Eagle
   4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
2.09 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, Inc
2. Electri-Flex Company
3. International Metal Hose
4. Substitutions: See Division 01 – General Requirements

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.10 SURFACE METAL RACEWAY

A. Manufacturers:
1. Hubbell Wiring Devices.
2. Thomas & Betts Corp.
3. The Wiremold Co.
4. Substitutions: Division 01 - General Requirements.

B. Surface Mounted Metal Raceways: V700 One-Piece Metal Raceway, G4000 Series Multi-Channel Steel Raceway, V2100 Single-Channel Metal Raceway by The Wiremold Company or approved equal.
1. Material: Galvanized steel, minimum thickness 0.040".
2. Finish: Factory-applied polyester topcoat applied over ivory base suitable for field-applied topcoat, color by Architect.
3. Steel Device Brackets and Plates: Steel overlap device plate for horizontal installation of devices. Plate shall overlap cover to conceal seam.
4. Plastic Overlapping Cover Bracket and Faceplate: Plastic device mounting bracket and trim plate for horizontal installation of devices. Plate shall overlap cover to conceal seam. Faceplate shall accept a variety of power and data/communication devices. Plastic shall be compatible with UL 94 for Plastic.
5. Adjustable Length Raceway Couplings: Provide raceway base sections with adjustable couplings. Each pair of couplings works in conjunction with the raceway base’s scored lines to allow less accurate field cuts. The coupling shall accommodate 4" of lateral movement and facilitate the ability of the raceway to maintain coordination with the wall framing as required. Each coupling shall provide a means of adding supplemental ground screws.
6. Fittings: Fittings shall include flat, internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, and end caps. Covers for fittings shall overlap adjoining raceway covers a minimum of 3/8". Fittings shall be color matched to the raceway. Supply fittings with a base where applicable to eliminate mitering. Provide fittings with
adjutable couplings that integrate with the raceway base. Provide a take-off fitting supporting dual services to adapt to existing flush wall boxes and other series of metallic raceways. Fittings shall have provisions to accept tamper resistant fasteners to fully secure the raceway.

a. Fiber Optic/UTP/STP Fittings: Corner elbows, tees, and entrance end fittings as required to maintain a controlled 2\" nominal cable bend radius that meets the specifications for Fiber Optic and UTP/STP cabling and exceeds TIA 569 requirements for communications pathways.

b. Obstacle Avoidance and Offset Fittings: Provide fittings as required to bypass large and small obstacles and small offsets in supporting wall. Small obstacle avoidance fitting capable of being converted into a takeoff fitting to transition to other metallic raceways.

7. Device Brackets and Plates:

a. Forward Fittings: Provide device brackets to install single-gang devices horizontally in either channel within the raceway. Provide horizontal device brackets with a single gang face plate. Horizontal device mounting brackets shall be a single piece with integral auxiliary grounding points. Device brackets and activation face plates shall allow the electrical or communications devices to face forward from the sidewall of the raceway.

b. Communications Devices and Accessories: Raceway shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6) STP (150 ohm) fiber optic, coaxial, and other cabling types with matching faceplates and bezels to facilitate mounting. Provide with complete line of preprinted station and port identification labels.

2.11 WIREWAY

A. Manufacturers:
1. Carlon Electrical Products.
2. Thomas & Betts Corp.
3. Hoffman.
4. Substitutions: See Division 01 – General Requirements

B. Construction:
1. Inside building: NEMA 1.
2. Outside building: NEMA 3R.

C. Knockouts: Manufacturer's standard.

D. Cover: Screw cover.

E. Connector: Slip-in.

F. Fittings: Lay-in type with removable top, bottom, and side.
Finish: Rust inhibiting primer coating with gray enamel finish.

2.12 BOXES

A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Manufacturers:
   a. Cooper Crouse-Hinds, a division of Eaton Corporation
   b. Hubbell Incorporated; Bell Products
   c. Hubbell Incorporated; RACO Products
   d. Leviton
   e. O-Z/Gedney, a brand of Emerson Industrial Automation
   f. Thomas & Betts Corporation
   g. Substitutions: See Division 01 – General Requirements
2. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
3. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
4. Use cast iron boxes or cast aluminum boxes with threaded hubs where exposed galvanized steel rigid metal conduit is used.
5. Use cast aluminum boxes with threaded hubs where aluminum rigid metal conduit is used.
6. Use nonmetallic boxes where exposed rigid PVC conduit is used.
7. Use suitable concrete type boxes where flush-mounted in concrete.
8. Use suitable masonry type boxes where flush-mounted in masonry walls.
9. Use raised covers suitable for the type of wall construction and device configuration where required.
10. Use shallow boxes where required by the type of wall construction.
11. Do not use "through-wall" boxes designed for access from both sides of wall.
12. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
13. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
14. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.

15. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.


17. Minimum Box Size, Unless Otherwise Indicated:
   a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep trade size.
   b. Communications Systems Outlets:
      1) Minimum 4 inch square by 2-1/8 inch trade size.
      2) Provide with single-gang drywall ring.
      3) Comply with Section 27 0533.
   c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep trade size.

18. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 1, painted steel.
      b. Outdoor Locations: Type 3R, painted steel.
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
      b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
      c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
      d. Provide with grounding stud.
      e. Provide with document pocket in cover.
   5. Finish for Painted Steel Enclosures: Manufacturer’s standard grey unless otherwise indicated.
   6. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation
      b. Hoffman, a brand of Pentair Technical Products
      c. Hubbell Incorporated; Wiegmann Products
      d. Substitutions: See Division 01 – General Requirements

D. Underground Boxes/Enclosures:
1. **Description:** In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.

2. **Size:** As indicated on drawings.

3. **Depth:** As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.

4. **Provide logo on cover to indicate type of service.**

5. **Applications:**
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 15 load rating.
   b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 22 load rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

6. **Polymer Concrete Underground Boxes/Enclosures:** Comply with SCTE 77.
   a. **Manufacturers:**
      1) Hubbell Incorporated; Quazite Products
      2) NewBasis
      3) MacLean Highline
      4) Substitutions: See Division 01 – General Requirements
   b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.13 **ACCESSORIES**

A. **Conduit Joint Compound:** Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

B. **Solvent Cement for PVC Conduit and Fittings:** As recommended by manufacturer of conduit and fittings to be installed.

C. **Pull Strings:** Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

D. **Sealing Compound for Sealing Fittings:** Listed for use with the particular fittings to be installed.

2.14 **MECHANICAL SLEEVE SEALS**

A. **Manufacturers:**
   1. Thunderline Link-Seal, Inc.
   2. NMP Corporation.
   3. PSI Link-Seal.
   4. Substitutions: See Division 01 – General Requirements
B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

C. Use: Provide for all penetrations through foundation walls.

PART 3 EXECUTION

3.01 EXAMINATION

A. See Division 01 – General Requirements.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

C. Verify that field measurements are as shown on drawings.

D. Verify that mounting surfaces are ready to receive conduits.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 EXISTING WORK

A. Remove exposed abandoned raceway including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

D. Maintain access to existing boxes and other installations remaining active and requiring access. Modify installation or provide access panel.

E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations or as specified.

F. Clean and repair existing raceway and boxes to remain or to be reinstalled.

3.03 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 260526.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 260529.
C. Identify raceway and boxes in accordance with Section 260553.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

E. Install products in accordance with manufacturer's instructions.

F. Perform work in accordance with NECA 1 (general workmanship).

G. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated and routing is not shown, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Unless otherwise approved, do not route conduits exposed:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
   e. Interior finished spaces.
5. Conduits installed underslab or embedded in concrete (see section 2.1 where applicable) may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
6. Arrange conduit to maintain adequate headroom, clearances, and access.
7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet between pull points.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
12. Maintain minimum clearance of 12 inches between conduits and surfaces exceeding 104 degrees F. This includes, but is not limited to:
   a. Heaters.
   b. Hot water piping.
   c. Flues.
13. Group parallel conduits in the same area together on a common rack.

H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
5. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is not permitted.

I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs 6” above finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable mechanical sleeve seals where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system.
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penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

9. Provide metal escutcheon plates for conduit penetrations exposed to public view.

10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07 Section 07 8400.

K. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
   b. Under Slab on Grade:
      1) Minimum 12 inches to bottom of slab.
      2) Depth as required to allow conduit to penetrate perpendicular to slab

2. Provide underground warning tape (exterior below grade) in accordance with Section 260553 along entire conduit length except where concrete-encased.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding in accordance with Section 260526.

P. Identify conduits in accordance with Section 260553.
Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

R. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

3.04 INSTALLATION – BOXES

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Install gang box with plaster ring for single device outlets.

I. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Division 08 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
      b. Communications Systems Outlets: Comply with Section 270533.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.

9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260534.

J. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 260529.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
   4. Install stamped steel bridges to fasten flush mounting outlet box between studs.
   5. Install adjustable steel channel fasteners for hung ceiling outlet box.

K. Install boxes plumb and level.

L. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Division 03, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer’s instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

S. Close unused box openings.

T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

U. Provide grounding and bonding in accordance with Section 260526.

V. Identify boxes in accordance with Section 260553.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.

B. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.06 ADJUSTING

A. See Division 01 – General Requirements Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused openings in boxes.

3.07 CLEANING

A. See Division 01 – General Requirements

B. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

C. Clean exposed surfaces and restore finish.
3.08 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section includes floor boxes; floor box service fittings; poke-through fittings; and access floor boxes.

B. Related Sections:
   1. Section 26 0533 - Raceway and Boxes for Electrical Systems.
   2. Section 26 2726 - Wiring Devices: Receptacles for installation in floor boxes.

1.02 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for floor boxes service fittings.

C. Samples: Submit two of each service fitting illustrating size, material, configuration, and finish.

1.04 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of each floor box and poke-through fitting.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.06 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two protective rings.
C. Furnish two carpet rings.

PART 2 PRODUCTS

2.01 FLOOR BOXES

A. Manufacturers:
1. Legrand/Wiremold
2. Leviton.
3. Bryant.
4. Hubbell.
5. Substitutions: Division 01 - Product Requirements.

B. Refer to drawings for basis of design model numbers.

C. Floor Boxes: NEMA OS 1.

D. For high capacity devices, power, data and AV outlets (as specified on drawings) shall be completely concealed and mounted on the side wall of floor box interior. Floor box shall utilize integral cable management with NO jacks being located on the top of the cover plate.

E. Floor boxes shall use sliding covers, flip-up covers are not acceptable.

F. Floor box shall be furnished with die cast aluminum cover assembly, with finish to be determined by architect.

G. Conduits: Provide device capable of accepting the following conduit terminations:

1. 3/4" for power.
2. 1-1/4" for data/telecommunications.
3. 2" for audiovisual.

H. Furnish with necessary furniture feed accessories when connecting to modular furniture.

I. Provide empty cover plates for sections without power/communication devices installed.

J. Installation: Contractor is responsible of trenching from floor mounted fitting location to nearest wall.

K. Provide final connections to furniture from furniture-feed devices as required by manufacturer.
PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify locations of floor boxes and outlets in offices, classrooms, laboratories and work areas prior to rough-in.

C. Verify openings in access floor are in proper locations.

3.02 INSTALLATION

A. Boxes and fittings are indicated on Drawings in approximate locations unless dimensioned. Adjust box location to accommodate intended purpose.

B. Floor Box Requirements: Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

C. Set floor boxes level.

D. Install boxes and fittings to preserve fire resistance rating of slabs and other elements, using materials and methods specified.

E. Install protective rings on active flush cover service fittings.

F. Coordinate installation of access floor boxes with access floor system and installing contractor.

3.03 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust floor box flush with finish flooring material.

3.04 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

END OF SECTION

FLOOR BOXES
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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Floor marking tape.
F. Warning signs and labels.

1.02 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements
B. Section 260400 – General Conditions for Electrical Trades.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

C. NFPA 70 - National Electrical Code.
D. NFPA 70E - Standard for Electrical Safety in the Workplace
E. UL 969 - Marking and Labeling Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Division 01- General Requirements

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 – General Requirements

B. Accept identification products on site in original containers. Inspect for damage.

C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.08 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Panelboards:
      1) Identify panel name.
      2) Identify ampere rating.
      3) Identify voltage and phase.
      4) Identify power source and circuit number. Include location when not within sight of equipment.
      5) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      6) Use typewritten circuit directory to identify load(s) served for panelboards with a door, including spares and spaces.
   b. Enclosed switches, circuit breakers, and motor controllers:
      1) Identify voltage and phase.
      2) Identify power source and circuit number. Include location when not within sight of equipment.
      3) Identify load(s) served. Include location when not within sight of equipment.

2. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

3. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

6. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.

7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches.
   b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
9. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

10. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

11. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

12. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 270553.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.

D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Color Code:
         a) Fire Alarm System: Red.
      2) Field-Painting: Comply with Division 09.
3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.

3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.

4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

5. Use underground warning tape to identify underground raceways.

6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

E. Identification for Cable Tray: Comply with Section 260536.

F. Identification for Boxes:
   1. Use voltage markers to identify highest voltage present.
   2. Use voltage markers or color coded boxes to identify systems other than normal power system.
      a. Color-Coded Boxes: Field-painted in accordance with Division 09 per the same color code used for raceways.
         1) Fire Alarm System: Red.
      b. For exposed boxes in public areas, do not color code.
   3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
      a. For exposed boxes in public areas, use only identification labels.
   4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

G. Identification for Devices:
   1. Identification for Communications Devices: Comply with Section 270553.
   2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
   3. Factory Pre-Marked Wallplates: Comply with Section 262726.
   4. Use identification label to identify fire alarm system devices.
      a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
   5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
      a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
   6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
   7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Manufacturers:
      a. Brimar Industries, Inc.
      b. Kolbi Pipe Marker Co.
      c. Seton Identification Products
      d. Substitutions: Division 01 - General Requirements.
   2. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum
         nameplates suitable for exterior use.
   3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or
      electrically non-conductive phenolic with beveled edges; minimum
      thickness of 1/16 inch; engraved text.
      a. Exception: Provide minimum thickness of 1/8 inch when any
         dimension is greater than 4 inches.
   4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or
      laser-etched text.
   5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch;
      engraved or laser-etched text.
   6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes
      up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Manufacturers:
      a. Brady Corporation
      b. Brother International Corporation
      c. Panduit Corp.
      d. Substitutions: Division 01 - General Requirements.
   2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water,
      heat, and abrasion resistant.
      a. Use only for indoor locations.
   3. Text: Use factory pre-printed or machine-printed text. Do not use
      handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend:
      a. System designation where applicable:
         1) Fire Alarm System: Identify with text "FIRE ALARM".
      b. Equipment designation or other approved description.
      c. Other information as indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. System Designation: 1 inch.
      b. Equipment Designation: 1/2 inch.
      c. Other Information: 1/4 inch.
d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.

5. Color:
   b. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   5. Color: Black text on white background unless otherwise indicated.
      a. Exceptions:
         1) Provide white text on red background for general information or operational instructions for emergency systems.
         2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
   1. Minimum Size: 2 inches by 4 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/2 inch.
   5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Power source and circuit number or other designation indicated.
      a. Include voltage and phase for other than 120 V, single phase circuits.
   3. Text: All capitalized unless otherwise indicated.
   5. Color: Black text on clear background.

G. Format for Control Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Load controlled or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
   1. Brady Corporation
   2. HellermannTyton
   3. Panduit Corp.
   4. Substitutions: Division 01 - General Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
   1. Do not use self-adhesive type markers.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
   1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
   1. Brady Corporation
   2. Brimar Industries, Inc.
   3. Seton Identification Products
   4. Substitutions: Division 01 - General Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.

F. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc.
   2. Clarion Safety Systems, LLC.
   3. Seton Identification Products
   4. Substitutions: Division 01 - General Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
      a. Do not use labels designed to be completed using handwritten text.
      b. Provide polyester overlaminate to protect handwritten text.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
  10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
   1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. General Requirements
   2. Line Voltage Switches
   3. Line Voltage Dimmer Switches
   4. Switch Plates.
   5. Line Voltage Occupancy/Vacancy Sensor Switches
   6. Low Voltage Occupancy/Vacancy Sensors
   7. Photocells
   8. Room Controllers / Power Packs
   9. Low Voltage Keypads / Switches.
   10. Class 2 Conductors and Cables

B. Related Sections:
   1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
   2. Section 26 05 19– Electrical Power Conductors and Cables.
   3. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
   4. Section 26 05 53 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
   5. Section 26 24 16 - Panelboards.
   6. Section 26 27 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.02 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT


1.03 SYSTEM DESCRIPTION

A. IECC compliant lighting controls to control all interior and exterior lighting:
   1. Standalone lighting controls in individual spaces consisting of some combination of occupancy sensors, vacancy sensors, photocells, power packs, low voltage switches and low voltage switches with dimming capability.

B. Refer to lighting control details and riser diagrams on the drawings for additional information.

C. Provide automatic shutoff for lighting inside building, where required. Control shutoff by method conforming to IECC.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switches with actual installed door swings and sidelights.
   3. Coordinate the placement of wall switch occupancy/vacancy sensors with actual installed door swings and sidelights.
   4. Coordinate the placement of occupancy/vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   5. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
   6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Protect lighting control devices during construction.
   2. Clean lighting control devices once final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Division 01 - General Requirements.

B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
1. One Line Diagram: Indicating system configuration, panels, number and type of switches or devices.
2. Include typical wiring diagrams for each component.
3. Floor Plan Layout Drawings: Manufacturers symbols are acceptable, provided that symbology between engineer’s device legend and manufacturers symbols are cross-referenced.

C. Product Data: Submit manufacturer’s standard product data for each system component. This shall include, but not be limited to: ratings, configurations, dimensions, sensor coverage ranges, colors, service condition requirements, and installation features.

D. Manufacturer’s Installation Instructions: Submit for each system component.

E. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

F. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections and evidence that the control schemes identified herein and shown on the typical lighting control details are configured and operational as specified.
   1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
   2. Provide documentation addressing each room/area control scheme specified with a description of how the submitted system complies.

1.06 CLOSEOUT SUBMITTALS

A. See Division 01 - General Requirements

B. Project Record Documents: Record the following information:
   1. Actual installed locations of components and settings for lighting control devices. Record circuiting and switching arrangements.
   2. Wiring diagrams reflecting field-installed conditions with identified and numbered system components and devices.

C. Operation and Maintenance Data:
   1. Submit replacement parts numbers.
   2. Submit manufacturer’s published installation instructions and operating instructions.
   3. Recommended renewal parts list.
   4. Detailed information on device programming and setup.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience. Company shall provide 24/7 telephone support by qualified technicians.
B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

C. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

D. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, assemblies, and system controllers shall be resolved between the contractor and the system provider, as required to ensure proper system operation and maintainability.

E. Performance Requirements: Shall provide all system components that have been manufactured, assembled, and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

F. Performance Testing Requirements
   1. Manufacturer shall 100% test all equipment prior to shipment. Sample testing is not acceptable.

G. Code Requirements
   1. System Control Unit and System Field Devices shall be UL listed and certified.
   2. All system components shall be FCC / IC compliant.
   3. All system components shall be installed in compliance with National Electrical Codes.
   4. Building Codes: All units shall be installed in compliance with applicable, local building codes.

1.08 PRE-INSTALLATION MEETINGS

A. See Division 01 - General Requirements.

B. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Division 01 - General Requirements.

B. Accept components on site in manufacturer’s packaging. Inspect for damage.

C. Protect components by storing in manufacturer’s containers indoor protected from weather.
1.10 WARRANTY

A. See Division 01 - General Requirements.

B. Furnish five year manufacturer warranty for all components.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES – GENERAL REQUIREMENTS

A. Manufacturers:
   1. Acuity
   2. Hubbell
   3. Douglas
   4. Substitutions: See Division 01 – General Requirements.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

D. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

E. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

F. Refer to lighting control details on drawings for additional requirements and product specifications.

2.02 LINE VOLTAGE SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated
   2. Leviton Manufacturing Co., Inc.
   3. Pass and Seymour/Legrand
   4. Substitutions: Division 01 - General Requirements.

B. Line Voltage Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.03 SWITCH PLATES

A. Manufacturers:
   1. Hubbell Incorporated
   2. Leviton Manufacturing Co., Inc.
   3. Pass and Seymour/Legrand
   4. Substitutions: [Division 01 - General Requirements] [Not Permitted].
      a. Where low voltage keypads / switches or line voltage sensor switches are shown, provide switch plate by same manufacturer.

B. Product Description: Specification Grade.
   1. Material: [Plastic] [Stainless steel] [Galvanized steel].

2.04 LINE VOLTAGE OCCUPANCY/VACANCY SENSOR SWITCHES

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Provide wall switch style occupancy/vacancy sensor capable of turning lights OFF when the space becomes unoccupied and ON when the space becomes re-occupied. Provide with 0-10V dimming capabilities and/or integral daylight control, where indicated on the drawings. Refer to drawings for occupancy or vacancy mode setting.

C. Sensor Switch Requirements:
   1. Sensor switch shall be line voltage @ 120/277 VAC, rated for 20A.
   2. Sensor technology shall be dual technology: PIR and ultrasonic.
   3. Sensor shall have field of view of 180 degrees.
   4. Sensor switch shall be capable of operating with LED.
   5. Sensor switch shall be set to:
      a. Auto-ON, Auto-OFF mode (Occupancy Sensor)
      b. Manual-ON, Auto-OFF mode (Vacancy Sensor)
      c. Dipswitch selectable to toggle between occupancy and vacancy mode.
   6. Sensor shall be capable of turning lights OFF after 20 minutes of inactivity. Switch shall also have 10 and 20 minute overrides.
7. Provide device capable of accepting a 2-wire (hot and neutral) input plus ground.
8. Sensor switch shall be capable of operating in conjunction with a 3-way switch per manufacturers requirements, where indicated on drawings.

2.05 LOW VOLTAGE OCCUPANCY/VACANCY SENSORS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Factory-assembled commercial grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated. Mounting as indicated on floor plans.

C. Sensor Requirements:
   1. Sensor Technology:
      a. Sensor shall be Dual Technology, unless otherwise noted on drawings. Available sensor technologies:
         1) Passive Infrared/Ultrasonic Dual Technology Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
         2) Passive Infrared/Acoustic Dual Technology Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing technologies.
   2. Sensor shall be set to:
      a. Auto-ON, Auto-OFF mode (Occupancy Sensor)
      b. Manual-ON, Auto-OFF mode (Vacancy Sensor)
      c. Dipswitch selectable to toggle between occupancy and vacancy mode.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   5. Passive Infrared Lens Field of View: Field customizable to block motion detection in selected areas.
   6. Sensor shall be capable of turning lights OFF after 20 minutes of inactivity. Switch shall also adjustable overrides.
   7. Sensitivity: Field adjustable.
   8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
   9. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
   10. Coverage:
        a. Small Space (< 500 Sq Ft): 500 square feet minimum
        b. Medium Space (500-1000 Sq Ft): 1,000 square feet minimum
        c. Large Space (>1000 Sq Ft): 2,000 square feet minimum. Multiple sensors where shown on the plans.
   11. Furnish with power pack or room controller by same manufacturer.
a. Provide for zone control and maximum number of sensors connected to power pack per manufacturer’s requirements.

b. Provide room controller with functions and quantity of zones as indicated on drawings and as required per manufacturer. Refer to Paragraph 2.9 for additional information.


D. Room Sensor Type: As indicated on Drawings.

E. Corridor and Hallway Sensors:
1. Capable of detecting major motion with a long, narrow pattern designed for corridor and aisle sensing. Refer to lighting control details for product specification.

2.06 PHOTOCELLS

A. Manufacturers: See Paragraph 2.1(A)

B. Product Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls. Sensor mounted as indicated on Drawings with separate control-calibration module. Control unit powered by 24 VAC.

C. Control-Calibration Module: Furnish with the following:
1. Capable of being switched between multiple measurement ranges.
2. Separate trip points for high and low response settings.
3. Three-minute time delay between switching outputs to avoid nuisance tripping.

D. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Photodiode with diffusing lens
2. Sensor Range:
   a. Indoor Photo Sensors: 5 to 100 footcandles (53.8 to 1,080 lx).
   b. Outdoor Photo Sensors: 5 to 250 footcandles (53.8 to 2,690 lx).
   c. Atrium Photo Sensors: 200 to 2,500 footcandles (2150 to 2,6910 lx).
   d. Skylight Photo Sensors: 1,000 to 6,000 footcandles (10,760 to 64,580 lx).
   e. Open Loop Photo Sensors: 3 to 6,000 footcandles (32.3 to 64,580 lx).
3. Finish: White unless otherwise indicated.

E. Standalone Dimming Photo Sensors: Photo sensor units with integral 0-10V controller compatible with specified dimming drivers/ballasts, for direct continuous dimming of up to 50 drivers/ballasts.
F. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

2.07 ROOM CONTROLLERS / POWER PACKS

A. Manufacturers: See Paragraph 2.1(A)

B. Refer to lighting control details on drawings for types, configurations, performance requirements, and additional information.

C. Description: Integrated lighting, dimming, and equipment switching control system for mounting in a concealed space, enclosure shall be plenum rated. Provide pre-configured lighting controller(s), with capabilities for manual setup, and software setup through programming port, configured as a standalone controller.
   1. Room Controllers.
   2. Power Packs.

D. Dimmable Load Types: 16A per channel at 100 to 277VAC, 50/60 Hz:
   1. 0 – 10V LED drivers.

E. General Requirements:
   1. Power Packs:
      a. Main Power: 100 – 277 VAC, 50/60 Hz.
      b. Input/Output (Refer to Drawings and Details for Input/Output Applicable to Project):
         1) Line Power Inputs: 1.
         2) Switch Channel Outputs: 1 or 2.
         3) 0 – 10V Dimmer Outputs: 1 - Class 1 or Class 2.
         4) Auxiliary Relay for Interface with Other Systems.
         5) Auxiliary Inputs: Hold On/Hold Off as specified.
      c. Enclosure: Plenum rated surface-mounted industrial control enclosure.
      d. Control Processor:
         1) Integrates sensors and other low voltage controls, devices, and subsystems through multiple control interfaces with control network. Refer to drawings for functions and operation required by project.

2.08 LOW VOLTAGE KEYPADS / SWITCHES

A. Provide low voltage keypads / switches with configuration, functionality and operation as indicated on drawings.

B. General Requirements:
   1. Custom engravable buttons/switches, refer to drawings for labeling. Refer to Paragraph C below for additional requirements.
2. Quantity and function as indicated on drawings.
3. LED indicators, as shown on drawings.
4. Configured to fit in standard gang boxes.
5. Color: By Architect

C. Labeling:
1. Provide factory engraved labels for all low voltage keypads / switches buttons.
2. Refer to lighting control details on drawings for suggested labeling of lighting control equipment. Coordinate naming of scenes/control zones with the Owner. Provide a worksheet listing remote keypad controls, labeling requests and locations to the Owner for their labeling requests.
3. Do not order labels until Owner coordination is complete.

D. Lighting keypad shall be provided by the same manufacturer as the lighting control system.

2.09 CLASS 2 CONDUCTORS AND CABLES

A. General Requirements:
1. Line Voltage Wiring: Comply with requirements of Division 26 Section "Electrical Power Conductors and Cables".
2. Class 2 Low-Voltage Cable:
   a. Provide plenum-rated cable.
   b. UTP Cable: CAT 5, CAT 6, or as required by manufacturer:
      1) Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      2) All cabling shall meet or exceed Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-C.2
      3) Cabling shall use 23AWG minimum conductors.
      4) Pulling tension: The cable pulling tension shall not exceed 25 ft/lbs as indicated in TIA/EIA-568-A.
   c. Control Cable:
      1) Stranded copper cable, Type CMP.
         a) Multiple-Conductor.
         b) Twisted Pair.
         c) Shielded Twisted Pair
         d) Minimum AWG: Per manufacturer requirements, as shown on drawings and details.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification:
1. Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer’s instruction.

2. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

3. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

4. Verify that final surface finishes are complete, including painting.

5. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

6. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

7. Verify that conditions are satisfactory for installation prior to starting work.

B. Inspection: Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.02 EXISTING WORK

A. Remove existing lighting control device wiring, including abandoned wiring above accessible ceilings. Cut cable flush with walls and floors, and patch surfaces.

B. Disconnect and remove abandoned lighting control equipment.

C. Maintain existing to remain lighting control system continuity outside the area of work. Extend existing lighting control system installations using materials and methods compatible with existing.

D. Clean and repair existing lighting control equipment to remain or to be re-installed.

3.03 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.04 INSTALLATION

A. The Electrical Contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control as described herein and shown on the plans (including but not limited to System Field Devices, 0-10V dimming ballasts, fixed output ballasts, 0-10V LED drivers and communication wire). The Electrical Contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure.
B. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards, unless otherwise indicated. Install per manufacturer’s instructions.

C. Power: The contractor shall test that all branch load circuits are operational before connecting loads to sensor system load terminals, and then de-energize all circuits before installation.

D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

E. Install wiring in accordance with Section 260519 and paragraph 2.13.

F. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit in accordance with Section 260533 and paragraph 2.13.

G. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

H. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.

I. Label each low voltage wire with relay number at each switch or sensor. Refer to Section 26 05 53.

J. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of lighting control devices provided under this section.

K. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

L. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

M. Prior to setting scenes or zones dependent on furniture placement, whiteboard locations, projection screen locations, lectern locations or similar, coordinate with the Owner, Architect and red-lined furniture plans. Make all required adjustments during construction.

N. Systems Integration:
   1. Equipment Integration Meeting:
      a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures prior to system startup.
O. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

P. Install lighting control devices plumb and level, and held securely in place.

Q. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

R. Identify lighting control devices in accordance with Section 260553.

S. Unless otherwise indicated, install power packs/room controllers for lighting control devices within the same space above accessible ceiling or above access panel in inaccessible ceiling.

T. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.05 SENSOR INSTALLATION:

A. Adjust sensitivity to cover area installed

B. Set time delay on sensors that are connect to the lighting control system to the minimum. Time delay to off shall be set to no longer than 20 minutes.

C. Provide vacancy sensor configurations as indicated on drawings.

D. Install sensors on vibration free stable surface.

E. Install atrium and skylight light sensor facing toward window or skylight.

F. Install interior light sensor in ceiling facing the floor.

G. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.

H. Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

I. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors away from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
J. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on sensor lenses to block undesired motion detection.

K. Daylighting Control Photo Sensor Locations:
   1. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize control and avoid conflicts or problems affecting proper detection of light levels.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
   4. Refer to drawings and details for maintained light level settings.

3.06 MANUFACTURER’S FIELD SERVICES

A. Division 01 - General Requirements.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following field tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing wall stations and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
   4. Test outdoor photo controls to verify proper operation, including time delays where applicable. Record test results in written report to be included with submittals.
   5. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
   6. Adjust relay panel settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings and as-built relay panel schedules in written report, to be included with submittals.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.
3.07 FIELD QUALITY CONTROL

A. Division 01 - General Requirements.

B. Inspect each lighting control device for damage and defects.

C. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.08 ADJUSTING

A. Division 01 - General Requirements.

B. Test contactors and switches after installation to confirm proper operation.

C. Confirm correct loads are recorded on directory card in each panel.

D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.09 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.10 COMMISSIONING

A. Division 01 - General Requirements.

3.11 DEMONSTRATION

A. Division 01 - General Requirements.

B. Demonstrate proper operation of lighting control devices to Architect and Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.
   4. Instructor: Qualified manufacturer’s representative familiar with the project and with sufficient knowledge of the installed lighting control devices.
D. Duration of Training: Per Section 260400.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards.
B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements.
B. Section 260526 - Grounding and Bonding for Electrical Systems.
C. Section 260529 - Hangers and Supports for Electrical Systems.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
B. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction.
D. NEMA FU 1 – Low Voltage Cartridge Fuses.
E. NECA 407 - Standard for Installing and Maintaining Panelboards.
F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
G. NEMA PB 1 - Panelboards.
H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems
J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT


M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.


1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
   4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.
   3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   4. Include documentation of listed series ratings upon request.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner’s use in maintenance of project.
   1. See Division 01 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.
   3. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer’s written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

1.09 WARRANTY

A. General: See Division 1 – Closeout Procedures.

B. Special Warranty: Submit a written warranty executed by the manufacturer, the Installer, and the Contractor, agreeing to repair or replace panelboards with branch metering that fail in materials or workmanship within the specified warranty period.
   1. Warranty Period: Warranty period shall be one year from the date of installation or 18 months from date of purchase.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/GE.

B. Eaton Corporation.

C. Schneider Electric; Square D Products.

D. Siemens Industry, Inc.

E. Substitutions: See Division 01 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
   a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
   b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
   b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   c. Provide removable end walls for NEMA Type 1 enclosures.
   d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided, list and label panelboards as a complete assembly including surge protective device.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
      c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.

L. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

M. Load centers are not acceptable.

N. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.
   2. Sub-feed lugs.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
2. Phase and Neutral Bus Material: Tin plated copper
3. Ground Bus Material: Copper

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
4. Provide clear plastic circuit directory holder mounted on inside of door.

F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.

2.04 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Provide compression lugs where indicated.
   c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
b. Provide interchangeable trip units where indicated.

5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

6. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.

8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.

9. Do not use tandem circuit breakers.

10. Do not use handle ties in lieu of multi-pole circuit breakers.

11. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

12. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
   c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   d. Under-voltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.05 SOURCE QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Factory test panelboards according to NEMA PB 1.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer’s instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer’s instructions and NFPA 70.

E. Provide required supports in accordance with Section 260529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Division 03.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 260526.

1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.

2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
L. Install all field-installed branch devices, components, and accessories.

M. Provide fuses complying with Section 262813 for fusible switches as indicated.

N. Install a permanent label indicating the panelboard or transformer where the power supply to the panel originates.

O. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

P. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

S. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 800 amperes. Tests listed as optional are not required.
   1. Perform insulation-resistance tests on all control wiring with respect to ground.
   2. Test functions of the trip unit by means of secondary injection.

E. Ground Fault Protection Systems: Test in accordance with manufacturer’s instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

F. Test GFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.
H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. See Division 01 – General Requirements.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

C. Adjust alignment of panelboard fronts.

D. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. See Division 01 – General Requirements.

B. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 PROTECTION

A. Protect installed panelboards from subsequent construction operations.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.
B. Wall plates.
C. Cord Reels.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements
B. Section 260400 – General Conditions for Electrical Trades
C. Section 260519 - Electrical Power Conductors and Cables.
D. Section 260526 - Grounding and Bonding for Electrical Systems.
E. Section 260503 – Equipment Wiring Connections.
F. Section 260533 – Raceways and Boxes for Electrical Systems.
G. Section 260553 - Identification for Electrical Systems.
H. Section 260923 - Lighting Control Devices.
I. Section 26 0534 - Floor Boxes for Electrical Systems: Service fittings for receptacles installed on floor boxes.
J. Section 26 0534 - Floor Boxes for Electrical Systems: Poke-through receptacles.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Revision H.
B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Revision G.
C. NECA 1 - Standard for Good Workmanship in Electrical Construction.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
E. NEMA WD 1 - General Color Requirements for Wiring Devices.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.


K. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.


M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Division 01 - General Requirements.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.
   2. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Samples: One for each type and color of device and wall plate specified.
D. Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.

E. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFCI Receptacles: Include information on status indicators.

G. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
D. Provide tamper resistant receptacles for receptacles where indicated on the drawings.

E. Provide GFCI protection for receptacles installed within 6 feet of water source.

F. Provide GFCI protection for receptacles installed in dwelling unit kitchens.

G. Provide GFCI protection in other than dwelling units for all single-phase receptacles rated 150 volts to ground or less and all three-phase receptacles rated 150 volts to ground or less, 100 amperes of less in: Bathrooms, Kitchens and on Rooftops

H. Provide GFCI protection for receptacles serving electric drinking fountains.

I. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WALL SWITCHES: See Section 260923 – Lighting Control Devices for specifications.

2.03 WALL DIMMERS: See Section 260923 – Lighting Control Devices for specifications.

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated
   2. Leviton Manufacturing Company, Inc.
   3. Pass & Seymour, a brand of Legrand North America, Inc.
   4. Substitutions: See Division 01 - General Requirements.
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.
   3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
   4. Body color:
      a. General Purpose Receptacles: color by Architect.
      b. Emergency, [Critical Branch], [Equipment Branch] receptacles: Red.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
      a. Provide test and reset buttons of same color as device.
   3. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
   4. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:
   1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
   2. Combination Duplex Receptacle: Provide with One USB Type-A and one USB Type-C charging port. Provide with 5-Amp, 5-Volt USB output. Provide Hubbell USB20AC5W or equal.

2.05 WALL PLATES

A. Manufacturers:
   1. Hubbell Incorporated
   2. Leviton Manufacturing Company, Inc.
   3. Pass & Seymour, a brand of Legrand North America, Inc.
   4. Substitutions: See Division 01 - General Requirements.
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Screws: Metal with slotted heads finished to match wall plate finish.
   3. Provide screwless wallplates with concealed mounting hardware where indicated.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.
E. Flip-up locking protective covers shall be provided where indicated on the drawings:
   1. Model: Legrand Da-Lite or approved equal.
   3. Furnish (2) keys for each locking cover.

2.06 CORD REELS

A. Manufacturers:
   1. Hubbell Wiring Device-Kellems
   2. RoboReel
   3. Reelcraft
   4. Substitutions: Division 01 - Product Requirements.

B. Basis of Design model:
   1. Hubbell #HBL45123R20WM1

C. Provide with mounting bracket to attach to ceiling or structure shown on drawings.

D. Provide with Duplex Receptacle pendant outlet box at end of cord: NEMA Type 5-20R.

E. Cord: Minimum 25’ length, 12 AWG.

F. Colors:
   1. Cord shall be black
   2. Receptacle housing shall be black
   3. Reel housing shall be white

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switches: 48 inches above finished floor.
   b. Wall Dimmers: 48 inches above finished floor.
   c. Fan Speed Controllers: 48 inches above finished floor.
   d. Receptacles: 18 inches above finished floor or 6 inches above counter.
   e. Install convenience GFCI type receptacles 36 to 48 inches above roof deck.
   f. Or at designated heights as indicated on drawings.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer’s instructions.

C. Install wiring devices in special application enclosures per manufacturer’s instructions, provide stainless steel cover plates.

D. Install wiring devices in accordance with manufacturer's instructions.

E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer.
present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper. When stranded conductors are used in lieu of solid, use insulated crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screw terminals.

I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

J. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

K. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

O. Do not share neutral conductor on branch circuits utilizing wall dimmers.

P. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

Q. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

R. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

S. Identify wiring devices in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect each wiring device for damage and defects.
C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI protected receptacle for proper tripping operation according to manufacturer's instructions.

F. Inspect each surge protection receptacle to verify surge protection is active.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer’s instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
   A. Section includes nonfusible switches.

1.02 REFERENCES
   A. National Electrical Manufacturers Association:
      1. NEMA FU 1 - Low Voltage Cartridge Fuses.
      2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches
         (600 Volts Maximum).
   B. International Electrical Testing Association:
      1. NETA ATS - Acceptance Testing Specifications for Electrical Power
         Distribution Equipment and Systems.

1.03 SUBMITTALS
   A. Division 01 - Submittal Procedures: Submittal procedures.
   B. Product Data: Submit switch ratings and enclosure dimensions.

1.04 CLOSEOUT SUBMITTALS
   A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
   B. Project Record Documents: Record actual locations of enclosed switches and ratings
      of installed fuses.

1.05 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this
      section with minimum three years experience.

PART 2 PRODUCTS

2.01 NONFUSIBLE SWITCH ASSEMBLIES
   A. Manufacturers:
      1. General Electric.
      2. Square D.
      3. Siemens.
      4. Eaton.
5. Substitutions: Division 01 - Product Requirements.

B. Product Description: NEMA KS 1, enclosed load interrupter knife switch. Handle lockable in OFF position.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer’s standard gray
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

D. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

E. Furnish switches with entirely copper current carrying parts.

F. Switch Rating: As indicated on drawings.

G. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

B. Height: 5 feet to operating handle.

C. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

D. Install engraved plastic nameplates in accordance with Section 26 05 53.

E. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

F. For switches feeding mechanical equipment, install switch within sight of the equipment.

3.02 COORDINATION WITH OTHER TRADES

A. It is the responsibility of the electrical contractor to furnish and install a safety switch for each electrical connection to mechanical equipment in the project, unless otherwise noted in the drawings.

B. It is the responsibility of the electrical contractor to install all safety switches furnished under DIVISION 23 – MECHANICAL WORK, DIVISION 22 – PLUMBING
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

WORK, AND DIVISION 21 – FIRE PROTECTION. Items with loose switches furnished
by other trades are notated in drawings.

C. Coordination between electrical and mechanical trades shall be anticipated.

3.03 FIELD QUALITY CONTROL

A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing,
adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Emergency power and gas shutoff systems:
   1. Combination gas/electric shutoff controllers for Commercial Kitchens.
   2. Solenoid Valves associated with the above systems (both gas and water) shall be furnished and installed under Division 22 – Plumbing; and wired by the electrical contractor.

B. Remote emergency-power-off pushbuttons.

1.02 RELATED REQUIREMENTS

A. Section 260400 – General Conditions for Electrical Trades.

B. Section 260526 - Grounding and Bonding.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262416 – Panelboards; For shunt trip breaker requirements.

F. Division 22 – Plumbing; For Solenoid valve specifications and electrical requirements.

G. Division 23 – Automatic Temperature Controls; For monitoring of these systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.


1.04 ADMINISTRATIVE REQUIREMENTS

A. Division 01 – General Requirements.

B. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
   3. Coordinate the work to provide motor controllers and associated wiring suitable for interface with control devices to be installed.
   4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   6. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain written direction before proceeding with work.

1.05 SUBMITTALS

A. Division 01 - General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for control panels, enclosures, relay devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, physical sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field Quality Control Test Reports.

1.06 CLOSEOUT SUBMITTALS

A. Prior to final acceptance, provide owner with complete operation and maintenance manuals. All aspects of the system operation and maintenance shall be detailed, including wiring diagrams of all circuits, written description of the system design and sequence of operation, drawing(s) illustrating control logic an equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, and maintenance operations and procedures shall be included in the manual. Upon completion of the system, provide owner with Four(4) copies of system “as-built” drawings. The drawing shall show actual installation details including equipment locations and conduit routing details.
1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.09 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

1.10 WARRANTY:

A. All system components furnished under this contract shall be guaranteed against defect and workmanship for a period of one year from date of acceptance.

PART 2 PRODUCTS

2.01 GAS AND ELECTRIC SHUTOFF SYSTEM FOR COMMERCIAL KITCHENS

A. Manufacturer:
   1. American Gas Safety, Merlin 1000S+ (Basis of Design)
   2. Isimet
   3. Asco
   4. Substitutions: Division 01 – General Requirements.

B. System Description:
   1. All Products and Devices for a complete Safety Device System with all components designed to operate together as a system. The system shall and be UL listed and labelled and be as listed.
   2. All components specified herein must be provided by the same manufacturer and shall be compatible with each other.

C. Utility Controller:
1. At each commercial kitchen and elsewhere as shown on Drawings, provide a Utility Controller with fascia panel mounted switches to activate remote solenoids and relays to control natural gas, and electrical contractors, remote control switches or other indicated services or devices. Utility Controller shall comply with Underwriter’s Laboratory UL61010-1 3rd Edition Standards. Controller shall have integrated printed circuit board and Microprocessor with adaptable programming features. Controller shall provide line voltage signals for output circuits. Controller shall provide inputs for remote EPO’s and Gas Sensors. The Controller shall be equipped with an Authority Key Lock that restricts activation of output signals to the instructor or educator. Controller shall be provided with a fascia mounted EPO button. Output signals will require Key Lock authority for re-set.

2. Technical Specifications:
   a. Power Supply 110-120vac, 50/60HZ
   b. Protection Overvoltage, overcurrent, surge protection (3amp)
   c. Enclosure Wall mounted Fully UL certified enclosure. Flush Mount kit available.
   d. Dimensions W: 10 1/16” x H: 7 1/16” x D: 3 1/16”
   e. Solenoid Valve #1 Signal Output 110-120vac, 50/60HZ
   f. Electrical Contactor or Remote Control Switch Signal Output 110-120vac, 50/60HZ
   g. BAS Output N/C COM N/O - Max 1A @ 120vac
   h. EM Stop Input Volt Free*
   i. Sensor Power Output : 24VDC
   j. Sensor Signal Input : Volt Free
   k. Adjustable Time-out period 2 hour, 4 hour, 8 hour or disabled
   l. Adjustable BAS Signal Output Alarm “on” or Gas “on” / Gas “off”

D. Fuel Gas Sensor:
1. AGS Merlin Natural /Methane Gas Sensor model # AGSNGXS or approved equal.
2. Furnish and install a minimum of (1) natural gas detector compatible with utility controller in each location indicated on plans. Integrate gas sensor with the controller.
3. Technical Specifications:
   a. Power Supply 7-30VDC, 80mA Max from Merlin Control Panel
   b. Gas Sensor Passive Semiconductor type sensor
   c. Measuring Range 300-10000 ppm
   d. Positioning of gas detector 12inch from ceiling
   e. Warm up time for turning-on 1 minute
   f. Low Level Alarm (Pre Alarm) 0.4% by volume
   g. High Level Alarm 0.5% by volume
   h. Volt free relay output 240VAC 500mA, 30VDC 2A switching current (resistive load)
   i. Net weight 180g
   j. Installation Wall Mountable Single Gang Rough In Box
   k. Standards / Approvals UL 2034 / UL 2075 UL 61010-1 3rd edition
2.02 EMERGENCY-POWER-OFF PUSHBUTTONS

A. Manufacturers:
   1. STI Stopper Station (Basis of Design)
   2. Square D
   3. Eaton
   4. Siemens
   5. Substitutions: Division 01 – Product Requirements.

B. Product Description: Mushroom style pushbutton for interfacing with contactors, remote control switches and shunt-trip circuit breakers.

C. Specifications:
   1. Color: Red, or as indicated on drawings.
   3. Cover: Flushed into wall, with flip-up cover, not alarmed.
   4. Switch Configuration: Momentary, turn-to-reset or keyed reset – as indicated on drawings or as required to interface with equipment specified on drawings.
   5. Isolated contacts: (1) Normally-open and (1) Normally-closed.
   6. Rated for voltage and operation indicated on drawings.

PART 3 EXECUTION

3.01 EXISTING WORK

A. Disconnect and remove abandoned shutoff systems.

B. Maintain access to existing shutoff systems and other installations to remain active and to require access. Modify installation or provide access panel.

C. Clean and repair existing shutoff system controllers and components to remain or to be reinstalled.

3.02 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that ratings of control panels and components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed control panels and components.

D. Verify that conditions are satisfactory for installation prior to starting work.
3.03 INSTALLATION

A. Provide services of a manufacturer's authorized representative to program and set up each system. Coordinate field programming, setup, configurations and testing with other trades to verify field operation of each system.

B. Install products in accordance with manufacturer's instructions.

C. Install motor controllers in accordance with NECA 1 (general workmanship).

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment components in accordance with Section 260529.

F. Install controllers and components plumb and level.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install all field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Finish and install all devices as shown in Drawings and as specified herein. Where device is to be installed by other trades, furnish and then turn over to appropriate trade for installation.

K. Furnish, install and make final connections to monitoring and remote EPO’s and Panic Buttons as indicated on Drawings and specified herein. Furnish and install low voltage and volt free control wiring from Utility Controller.

3.04 COORDINATION WITH OTHER TRADES

A. It is the responsibility of the electrical contractor to install connections from controllers to solenoid valves furnished under DIVISION 22 – PLUMBING WORK. Coordinate exact point of connection with plumbing drawings prior to installation.

3.05 FIELD QUALITY CONTROL

A. Division 01 – General Requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. The electrical contractor is responsible for testing of system after all distribution panelboards, HVAC equipment, fire suppression systems and dampers have been
installed on site. The EC shall submit for record and approval the results of said testing and make all corrections to equipment connections and system setup as required for complete system operation. The EC shall make provisions to revisit site after installation of all equipment is complete if necessary.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Prior to placing the shutoff system into service, perform ALL Start-Up procedures and checklists as stated in Manufacturer’s Operations and Maintenance Procedure.

F. Verify that all components and devices comply with manufacturer’s requirements and recommendations and that all devices and installations conform to Drawings and specification requirements.

3.06 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer’s recommended torque settings.

3.07 CLEANING

A. Clean dirt and debris from motor controller enclosures and components according to manufacturer’s instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.08 CLOSEOUT ACTIVITIES

A. Division 01 – General Requirements.

B. Demonstration: Demonstrate proper operation of shutoff systems to Owner, and correct deficiencies or make adjustments as directed.

C. Upon completion of ALL Start-Up tests, place the system into service. Complete all warranty registration documents. Submit originals with other project related closeout and O & M documentation. Review all operating procedures with a representative of the owner. Provide all System Authority Keys (where applicable) to the owner’s representative.

D. Training: Train Owner’s personnel on operation, adjustment, and maintenance of enclosed motor controllers and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Instructor: Manufacturer’s authorized representative.
   3. Location: At project site.

E. Duration of Training: Per Section 260400.
3.09 PROTECTION

A. Protect installed enclosed motor controllers from subsequent construction operations.

END OF SECTION
SECTION 26 51 00
LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.
B. Exit signs.
C. Ballasts and drivers.
D. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
B. Section 26 0923 - Lighting Control Devices
C. Lighting Fixture Schedule as indicated on drawings.

1.03 REFERENCE STANDARDS

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.
F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
H. UL 1598 - Luminaires; Current Edition, Including All Revisions.
1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility, installed by other sections or others.
   4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA LM-79 and IESNA LM-80.
      a. Manufacturers' Certified Data: Photometric data certified by manufacturer’s laboratory with a current accreditation under the
National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

b. Testing Agency Certified Data: Photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

c. TM-21 report for L70 rating at color temperature specified.

E. Sustainable Design Documentation: Submit manufacturer’s product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

F. Field quality control reports.

G. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.06 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.07 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 QUALIFICATION DATA: For testing laboratory providing photometric data for luminaires.

A. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

1.09 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer’s written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.10 FIELD CONDITIONS

A. Maintain field conditions within the manufacturer's required service conditions during and after installation.

1.11 WARRANTY

A. Unless otherwise noted in Lighting Fixture Schedule, Provide **FIVE year** manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in Lighting Fixture Schedule included on the drawings.

B. Substitutions:

1. Substitutions are not permitted where indicated as such on the drawings. These products shall be considered the Basis of Design.

2. Where substitutions are permitted:
   a. Approved equals to the basis of design fixture listed in the Lighting Fixture Schedule shall be accepted for review with the proposed substitute fixture meeting the following minimum requirements:
      1) Be of the same general size, style and shape, including but not limited to lens construction and shading.
      2) Be of equal or better quality and construction.
      3) Be supplied with all required accessories to match the specified fixture.
      4) Be supplied with all remote drivers, power supplies and cabling lengths to meet specified performance and control.
5) Provide the same or better distribution, efficiency, source lumen output, and L70 lumen depreciation metric.
b. Provide point by point photometric calculations at the request of the Engineer for evaluation.
c. The basis of design fixture listed in the Lighting Fixture Schedule lists part numbers, specifications, options, accessories and source output available at the time of design. Substitutions shall meet these requirements as scheduled.
d. The evaluation of an approved equal shall be at the sole discretion of the Architect and Engineer.

2.02 INTERIOR LUMINAIRES

A. Manufacturers: See paragraph 2.1.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Provide products complying with Federal Energy Management Program (FEMP) requirements.

F. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

G. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

H. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

I. Recessed Luminaires:
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
   4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
      a. Luminaires for Air Supply/Return: Provide air control blades where indicated.
J. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EXIT SIGNS

A. Manufacturers: See paragraph 2.1.

B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: Universal type for field adjustment sized so that they are clearly visible at a distance of 40 feet as required by local codes.
   3. Mounting: Wall, ceiling or pendant as indicated. Provide universal mount exit signs where indicated.
   4. Housing: Varies, refer to Lighting Fixture Schedule.
   5. Face: Varies, refer to Lighting Fixture Schedule.

C. Special Wording Signs: Provide with special wording as indicated.
   1. Where indicated, provide with international symbol of accessibility complying with state and local codes.
   2. Provide combination exit/special wording signs where indicated.

D. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

2.04 MATERIALS

A. Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.
   4. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
   5. Diffusers and Globes:
      a. Refer to Interior Lighting Fixture Schedule for types.
b. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
c. Glass: Annealed crystal glass unless otherwise indicated.
d. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

6. Housings:
a. Extruded-aluminum housing and heat sink unless otherwise indicated.
b. Powder-coat finish unless otherwise indicated, color selection by Architect.

7. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
a. Label shall include the following lamp characteristics:
   1) “USE ONLY” and include specific lamp type.
   2) Lamp diameter, shape, size, wattage, and coating.
   3) CCT and CRI for all luminaires.

B. METAL FINISHES
1. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.05 BALLASTS AND DRIVERS

A. Manufacturers:
1. eldoLED.
2. General Electric Company.
3. Lutron Electronics Company.
4. Osram Sylvania.
5. Philips Lighting Electronics/Advance.
7. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
8. Where a specific manufacturer or model is indicated elsewhere in the luminaire schedule or on the drawings, substitutions are not permitted unless explicitly indicated.
9. Provide ballasts/drivers compatible with the approved lighting control systems.

B. LED Drivers:
1. Product Description: LED dimming driver.
a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
b. Digital (DALI Low Voltage Controlled) Dimming Drivers
c. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
2. General:
   a. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
   b. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
   c. Driver must limit inrush current.
      1) Base specification: Meet or exceed NEMA 410 driver inrush standard of 430 Amps per 10 Amps load with a maximum of 370 Amps2 – seconds.
      2) Preferred Specification: Meet or exceed 30mA2s at 277VAC for up to 50 watts of load and 75A at 240us at 277VAC for 100 watts of load.
   d. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
   e. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
   f. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
   g. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
      1) Adjustment of forward LED voltage, supporting 3V through 55V.
      2) Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA
      3) Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
   h. Driver must be able to operate for a (+/- 10%) supply voltage of 120V through 277VAC at 60Hz.
   i. Driver should be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
   j. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts
or less in this standby. Control deadband between 0.5V and 0.65V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

3. Light Quality
   a. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 1 percent and 10% relative light output where indicated, or 100 – 10% light standard. Driver shall respond similarly when raising from 1% to 100%
   b. 1) Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
   c. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
   d. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-1 percent luminaire shall have:
      1) LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
      2) Base specification: Flicker index shall less that 5% at all frequencies below
      3) 1000 Hz.
      4) Preferred specification: Flicker index shall be equal to incandescent, less that 1% at all frequencies below 1000 Hz.

4. Control Input
   a. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
      1) Must meet IEC 60929 Annex E for General White Lighting LED drivers
      2) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
      3) Must meet ESTA E1.3 for RGBW LED drivers
   b. Digital (DALI Low Voltage Controlled) Dimming Drivers
      1) Must meet IEC 62386
   c. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
      1) Must meet DMX / RDM: USITT DMX512A and ANSI E1.20 (Explore & Address)
      2) Capable of signal interpolation and smoothing of color and intensity transitions

5. Driver: Approved by dimming system manufacturer as suitable for operation with control unit and suitable for LED source type and quantity specified for luminaire.
2.06 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 “Hangers and Supports for Electrical Systems” for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with heavy duty swivel ball fittings and ceiling canopy. Finish same as luminaire.


D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

F. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps, and accessories.

B. Extend existing luminaire, emergency lighting and exit sign installations using materials and methods compatible with existing installations, or as specified.

C. Clean and repair existing luminaires, emergency lighting units and exit signs to remain or to be reinstalled.

3.02 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.03 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.04 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires, emergency lighting units and exit signs provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer’s instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box, heavy-duty swivel hangers and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   6. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
   7. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   8. See Division 09 - Finishes where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   3. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   4. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
5. Install recessed luminaires to permit removal from below.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet (1.2 m) between supports.
4. Install canopies tight to mounting surface.
5. Secure pendant-mounted luminaires to building structure.
7. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
8. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.
3. Install plumb and adjust to align with building lines and with each other. Secure to prevent movement.
4. Install suspended exit signs using pendants from swivel hangers. Install pendant lengths required to suspend sign at height indicated or as instructed by the Authority Having Jurisdiction.

M. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

N. Install accessories furnished with each luminaire.

O. Connect luminaires to branch circuit using flexible conduit, except for emergency lighting which shall be in conduit completely.
P. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Q. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.05 FIELD QUALITY CONTROL

A. See Division 01 – General Requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.06 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.07 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean photometric surfaces as recommended by the manufacturer.

3.08 CLOSEOUT ACTIVITIES

A. See Division 01- General Requirements

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.09 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for communications equipment, conduit, cable, boxes, and other communications work.

1.02 RELATED REQUIREMENTS

A. Division 01 – General Requirements
B. Section 260400 – General Conditions for Electrical Trades
C. Section 260529 – Hangers and Supports for Electrical Systems
D. Section 271000 – Structured Cabling

1.03 REFERENCE STANDARDS

D. MFMA-4 - Metal Framing Standards Publication; 2004.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. See Division 01: General Requirements.
B. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components being installed.
2. Coordinate the work with other trades and provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with latest adopted version of applicable building code, including any addendum or supplements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 260400 General Requirements for Electrical Trades.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
PART 2 PRODUCTS

2.01 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 27 Communications, except where specified otherwise herein.

2.02 J-HOOK SUPPORTS

A. Manufacturers:
   1. Easton/Cooper B-Line – “BCH” Series
   2. Caddy
   3. Chatsworth
   4. Substitutions: Division 01 - General Requirements

B. Product Description: Low-voltage and communication fasteners for routing of cabling from telecommunication room to work area outlet. J-hooks shall support all communications cabling in the project. Including, but not limited to, Category 6, 6A, fiber, speaker cabling, coaxial, security, and others.

C. Specifications:
   1. Pre-galvanized steel finish
   2. Static load capacity: 30 lbs
   3. Quick latching cable retainer

D. Furnish with all required connectors, fasteners and accessories.

E. J-Hooks shall be sized to correctly support the number of cables, which pass through them. Under no circumstances shall cable quantity exceed 50 in any given support. Fill capacity shall be as required by code for conduit. That is to say that every J-Hook shall have a maximum of 40 percent fill capacity. Install additional supports as required.

PART 3 EXECUTION

3.01 Refer to Section 260529 – Hangers and Supports for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 27 Communications, except where specified separately herein.

3.02 INSTALLATION – COMMUNICATIONS SYSTEM SUPPORT COMPONENTS

A. Backboxes for communications devices shall be permitted to be supported from a grid ceiling. A tile bridge shall be furnished for this purpose. Refer to Section 26 05 33.

B. Overhead speakers, plenum boxes, audiovisual equipment, and other devices weighing more than a standard electrical backbox shall be supported via a threaded rod fastened to the building structure.
C. J-hooks shall be furnished with cable-to-beam fasteners and shall be fastened to the building structure.

D. Separate J-hooks shall be furnished and installed for different systems. The following systems shall be routed in separate j-hook pathways:
   1. Data cabling
   2. Speaker cabling
   3. Security cabling

E. J-hook pathways shall be separated from power cabling by a minimum of 12 inches.

F. J-hook pathways shall be separated from the load side wiring of dimmer controls by a minimum of 24 inches.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Raceway and Boxes for Communications Systems.

B. Related Sections:
   1. Section 260400 – General Conditions for Electrical Trades.
   2. Section 260526 - Grounding and Bonding for Electrical Systems.
   4. Section 260534 - Floor Boxes for Electrical Systems.
   5. Section 270529 - Hangers and Supports for Communications Systems.
   6. Section 270553 - Identification for Communications Systems.

1.02 REFERENCES

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC);
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S);
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A);
D. NECA 1 - Standard for Good Workmanship in Electrical Construction;
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT);
F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit;
G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC);
H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable;
I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit;
J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit;
K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing;
L. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT);
M. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
N. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
O. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
S. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
X. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.
AA. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Division 01 – General Requirements.

B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for all conduits and fittings outlined in Part 2.

C. Manufacturer’s Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

D. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within or under structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

E. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs (where permitted), and conduits 2 inch trade size and larger.

F. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

G. Product Data: Provide manufacturer’s standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

H. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 – General Requirements.
   2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE
   A. Conform to requirements of NFPA 70.
   B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
   C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. See Division 01 – General Requirements
   B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
   C. Protect PVC conduit from sunlight.
   D. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer’s instructions.

1.08 COORDINATION
   A. See Division 01 – General Requirements
   B. Coordinate installation of outlet boxes for equipment connected under Section 260503.
   C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.
   D. Communications contractor is responsible to fully coordinate with the site and concrete contractors and all other trades when routing conduit underslab. Routing of conduit underslab may be acceptable, provided spacing of conduits is adequate for proper backfilling of area surrounding conduits. Adequate spacing shall mean using factory made conduit spacers that allow for a minimum of 3-inches for backfilling with sand or 3 times the pipe diameter for backfilling with a structural fill. Proposed conduit routing, installation and methods and backfilling procedures shall be submitted to the Engineer for review prior to installation.
PART 2 PRODUCTS

2.01 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 2 Product requirements listed in this Section shall apply to Division 27 Communications.

PART 3 EXECUTION

3.01 Refer to Section 260533 – Raceway and Boxes for Electrical Systems. All Part 3 Execution requirements listed in this Section shall apply to Division 27 Communications.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communication system identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.

1.02 RELATED REQUIREMENTS (follow the most currently adopted amended version)

A. See Division 01 – General Requirements
B. Division 09 - Finishes.
C. Section 260400 – General Conditions for Electrical Trades.
D. Section 260553 – Identification for Electrical Trades.

1.03 REFERENCE STANDARDS (follow the most currently adopted amended version)

C. NFPA 70 - National Electrical Code.
D. NFPA 70E - Standard for Electrical Safety in the Workplace
E. UL 969 - Marking and Labeling Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.
1.05 SUBMITTALS
A. See Division 01- General Requirements
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 DELIVERY, STORAGE, AND HANDLING
A. See Division 01 – General Requirements
B. Accept identification products on site in original containers. Inspect for damage.
C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 QUALITY ASSURANCE
A. Conform to requirements of NFPA 70.

1.08 FIELD CONDITIONS
A. Do not install adhesive products when ambient temperature and humidity is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 Refer to Section 260553 – Identification for Electrical Systems. All Part 2 Product requirements listed in this Section shall also apply to Division 27 Communications.

PART 3 EXECUTION

3.01 Refer to Section 260553 – Identification for Electrical Systems. All Part 3 Execution requirements listed in this Section shall also apply to Division 27 Communications, except where specified separately herein.

3.02 INSTALLATION – COMMUNICATIONS SYSTEM LABELING
A. Label Installation:
1. All labeling standards shall be confirmed with and approved by owner’s IT staff prior to performing work. It is the responsibility of the contractor to coordinate with owner’s staff.

2. Labeling procedures shall meet TIA/EIA 568B Series standard and BICSI Standards and shall be pre-approved by the Owner.

3. Permanently label, using pre-printed labels, all cables and terminations.
   a. Patch panels and cross-connect blocks, numerically from top to bottom.
   b. Patch panel port with work area outlet label.
   c. Cable segments.

4. Install label parallel to equipment lines.

5. Use industry standard TIA/EIA and BISCI color codes.

6. Each work station outlet jack and corresponding patch panel port shall be marked with the same, unique label.

7. Mark the plate with standard nomenclature as required by the configuration. Mark the outlet plainly and neatly with its station identification, as indicated in above paragraph. The station identification shall also be marked inside the outlet plate on the backing plate of the outlet, and shall match the ID used at the patch panel port. Make the outlet marking using the Panduit system or equal, except for the inside marking which may be by indelible marker. Place exposed marking on outlet plates under a transparent window for protection. Label cable with permanent marker compliant with EIA/TIA 606, six (6) inches back from the termination at both ends.

B. Wire Label Installation:
   1. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
   2. Install labels at data outlets identifying patch panel and port designation as specified.

C. Conduit Marker Installation:
   1. Install conduit marker for each conduit longer than 10 feet.
   2. Conduit Marker Spacing: 20 feet on center.

END OF SECTION
CHAPTER 27 10 00
STRUCTURED CABLING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes communications equipment room fittings, communications backbone cabling, communications horizontal cabling, work area outlets, patch cabling, connecting cords, devices and adapters.

B. Related Sections:
   1. Division 01 – General Requirements
   2. Section 26 0400 – General Conditions for Electrical Trades
   3. Section 26 0526 – Grounding and Bonding
   4. Section 27 0529 – Hangers and Supports for Communications Systems
   5. Section 27 0533 – Conduit and Backboxes for Communications Systems
   6. Section 27 0553 – Identification for Communications Systems

1.02 REFERENCES

A. All wire and components supplied and installed shall meet the requirements of the following and all sub-referenced documents:
   1. The National Electrical Code, Article 800.
   2. International Electrical Testing Association:
   3. National Fire Protection Association:
      a. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
   4. Underwriters Laboratories, Inc.:

B. All components supplied and installed shall meet the requirements of the following standards set forth by the Telecommunications Industry Association/ Electronic Industries Alliance:
   1. TIA/EIA-569-C – Telecommunications Pathways and Spaces.
   2. TIA/EIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
   5. TIA/EIA 568-C.3 – Optical Fiber Cabling Components.
1.03 SYSTEM DESCRIPTION

A. Horizontal pathway: Conform to TIA/EIA 569 using conduit, sleeves, J-Hooks, and other methods indicated on drawings.

B. Horizontal cabling: Cable connections in structured cabling between equipment rooms/telecommunications closets to the work area outlet. Horizontal cabling consists of the transmission media, main and intermediate cross-connects and terminations at these locations.

C. Structured Cabling system shall include equipment room fittings, racks, cabinets, and accessories.

D. System shall be completely tested, certified and warrantied as specified herein.

E. System shall include record drawings and documentation.

F. System shall include operation and maintenance instruction manuals.

1.04 SUBMITTALS

A. Division 01 – General Requirements.

B. Product Data: Provide manufacturer’s standard catalog pages and data sheets for all products specified herein. Include detailed information on equipment construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, performance, installed accessories, and compatibility; include model number nomenclature clearly marked with all proposed features.

C. Test Reports: Indicate procedures and results for specified field testing and inspection.

D. Submit for review installer qualifications as specified herein.

E. Submit for approval a typical work area outlet panel diagram with labeling, AFTER coordination with Owner to verify labeling standard. All labels shall be coordinated with the Owner as specified herein, and in Section 27 0553.

1.05 CLOSEOUT SUBMITTALS

A. Division 01- General Requirements.

B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

C. Submit as-built drawings for review.

D. Submit operations and maintenance data for review.
1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum THREE YEARS documented experience.

B. UL Compliance: The communication system supplied shall be listed by Underwriters’ Laboratories under the UL Standard 1459 for Telephone Appliances and Equipment. A copy of the UL listing card for the proposed system shall be included with the contractor’s submittal.

C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems that are not FCC approved or that utilize intermediary devices for connection, shall not be considered. Provide FCC registration number of the system being proposed as part of the submittal process.

D. Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 50 miles of project.

   1. Evidence of ability: Furnish training certifications. Certified training shall be industry recognized at least equal to:
      b. Ortronics Certified installer.
      c. Hubbell Certified installer.
      d. Leviton Certified Installer.
      e. Siemon Cabling System Certified Installer.

E. Provide a full time, on-site Project manager to supervise the project.

F. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Division 01– General Requirements.

B. Convene minimum THREE WEEKS prior to commencing work of this section.

1.08 EXTRA MATERIALS

A. Division 01 – General Requirements.

B. Furnish ten single gang 4-port face plates.

C. Furnish ten communications outlet jacks of each type.

D. Furnish 2-48 port patch panels.
E. Furnish 2-horizontal wire managers.

F. Furnish five of each length and type of patch cords.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.10 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

B. Pre-installation Conference: Conduct conference at project site to comply with requirements in Division 01.

1.11 WARRANTY

A. Provide a warranty for minimum one (1) year against defects in material and workmanship on all components, equipment, software, systems, cabling, etc. as specified herein.

B. Data Cabling Warranty: provide a manufacturer’s data cabling twenty-five (25) year system performance warranty for the voice and data structured cabling system.
   1. The Contractor shall provide documented proof that he/she is authorized and certified and in good standing with the manufactures to provide this warranty.
   2. The contractor shall provide a written 25-year warranty from the manufacturer at substantial completion of the project.
   3. The warranty shall include connecting hardware products and installed cable as part of the data cabling system warranty.
   4. The data cabling system shall include:
      a. Work area outlets.
      b. Horizontal cable.
      c. The connecting hardware in the horizontal cross-connect.
   5. The manufacturer’s warranty shall guarantee that the data cabling system shall be free from defects in materials and workmanship for the duration of the warranty.

PART 2 PRODUCTS

2.01 HORIZONTAL CABLE (CATEGORY 6)

A. Manufacturers:
   1. Hitachi Cable America, Inc. – Premium Enhanced UTP Cat.6
2. Siemon
3. Hubbell
4. Mohawk/Belden
5. Substitutions: Division 01 – General Requirements.

B. All cabling shall meet or exceed Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA 568-C.2, adhering to Category 6 specifications.

C. All horizontal cabling shall be communications plenum cable type (CMP).

D. Cabling shall use 23AWG minimum conductors.

E. Pulling tension: The cable pulling tension shall not exceed 25 ft/lbs as indicated in TIA/EIA-568-A.

F. Coordinate color of horizontal cabling with the Owner.

G. Category 6 cabling shall have the following worst-case headroom losses:
   1. NEXT Loss: +5 dB (Guaranteed Worst Case Headroom)
   2. PSNEXT Loss: +5 dB (Guaranteed Worst Case Headroom)
   3. ACRF: +6 dB (Guaranteed Worst Case Headroom)
   4. PSACRF: +6 dB (Guaranteed Worst Case Headroom)

H. Category 6 cabling shall support 1 gigabit Ethernet.

I. Category 6 cabling shall support the following Power-over-Ethernet protocols:
   1. 15W PoE (IEEE 802.3af)
   2. 30W PoE+ (IEEE 802.3at)
   3. 60W PoE++ (IEEE 802.3bt Type 3)

J. Cable outside diameter: 0.20 inch.

K. UTP Patch Cords: Supply patch cords which meet the following specification and are of the same TIA/EIA category rating and manufacturer as the workstation cabling:
   1. EIA/TIA 568-C.2 Category 6 to match patch panel type.
   2. 24 AWG stranded conductors
   3. Quantity: (48) per each Patch Panel provided for the project, plus 10% spare capacity
   4. Length: 50% shall be 7 feet, 50% shall be 5 feet.

2.02 PATCH PANELS AND TERMINATIONS FOR HORIZONTAL CABLE

A. Manufacturers:
   1. Hubbell – Nextspeed
   2. Ortronics/Legrand
   3. Siemon
   4. Substitutions: Division 01 – General Requirements.

B. Product Description: TIA/EIA 568B rack-mounted panels.
C. Panels shall be ANGLED, 48 port, 2U, TIA/EIA 568B Cat. 6/6A type with integral printed circuit board, color coding, IDC type terminations, and 8-position jacks.
   1. Patch panels shall be either Category 6 or 6A, to match horizontal cabling type.
   2. Provide high density rack mounted patch panels.
   3. Modular port connectors that allow pre-connectorized cables to be connected to the rear of the ports are specifically prohibited. All horizontal cables shall be punched to a single point IDC-type connection on the rear of each port connector only.
   4. Each port shall have color-coded identification label.

D. Quantity: Contractor is responsible for providing quantity of patch panels required to terminate all cabling indicated on drawings at associated equipment rooms. This shall include separate patch panels for different systems where this requirement is dictated on drawings (i.e. separate patch panels for data, VOIP, wireless, building systems, and other systems indicated).
   1. Contractor shall provide quantity of patch panels required to accommodate indicated horizontal cabling with minimum 20% spare port capacity.

E. Provide horizontal wire management above and below each patch panel. Provide rear cable management bar with strain-relief brackets behind each patch panel.

2.03 WORK AREA OUTLET

A. Manufacturers:
   1. Hubbell
   2. Ortronics/Legrand
   3. Siemon
   4. Substitutions: Division 01 – General Requirements.

B. Product Description: Assembly consisting of faceplate and modular connectors that meet or exceed TIA/EIA-568B, Category 6 or 6A standard, to match horizontal cabling type.

C. Each Work Area outlet shall consist of the following:
   1. Single or double gang thermoplastic faceplate equipped with front-loading modules with the number of voice and data jacks indicated on the Drawings and Specifications.
   2. Provide faceplate with clear plastic window on the top and bottom of the faceplate for labeling.
   4. Provide blank-off modules for all empty positions.
   5. Provide modular jacks that meet or exceed Category 6/6A requirements for connecting hardware as specified in TIA/EIA-568B.2 standard (type as indicated on drawings). Jacks shall be front loading, 110 style, 8-pin IDC, and RJ45 type.
6. Color of each jack shall match the color of the horizontal cable. Coordinate all color requirements with the Owner and Architect.

D. Wall phone outlets shall have stainless steel recessed wallplates.

PART 3 EXECUTION

3.01 INSTALLATION

A. Rated Stairs: Penetrations into stairs are NOT permitted except for items serving that stair.

B. Wiring Method:
1. Install all required telecommunications conduits, sleeves, and back boxes. Conduits, sleeves and boxes shall be installed in accordance with Section 270533.
2. Install cables in raceways, conduits and interstitial spaces above suspended ceilings.
3. Conceal wiring except in unfinished spaces.
4. Wire shall not be subjected to pulling tensions greater the maximum specified by the manufacturer.
5. Wire bend radius shall not be less than the manufacturer’s minimum of one (1) inch.
6. Support cables that are not in raceway or conduit at intervals no greater than 60 inches with supports designed for high-speed twisted pair wire ("J" hooks).

C. Horizontal Cables:
1. Mount new station jacks on the specified plate, flush or surface mounted, as construction requires.
2. At the station end, terminate 4-pair UTP cables on 8-pin modular jacks according to TIA/EIA 568B terminating specifications.
3. At the telecom room, terminate all 4-pair UTP cables (voice & data) onto panel mounted 8-pin modular connectors that meet the TIA/EIA 568B specification. Provide sufficient patch jacks (ports) at each telecom closet to terminate the cables from all of the stations served by that closet. Mark the voice and data patch terminating jacks with its associated station identification in ascending sequential order. Mark patch panel using the Panduit system or equal. Match the patch panels into the supplied equipment racks.
4. Provide 9” of slack on outlet boxes behind each faceplate.

D. Supports:
1. Cabling shall be supported via cable trays where indicated in drawings. Cabling between cable tray and work station shall be supported via J-Hooks as indicated in drawings. Where cable tray is not indicated on drawings,
cabling shall be supported via J-Hooks along entire run from telecom room to work area outlet.

2. Refer to Section 27 0529 – Hangers and Supports for Communications Systems for J-hook product and installation requirements.

E. Grounding of telecommunications equipment and cabling:

1. Ground all equipment in accordance with Section 26 0526 – Grounding and Bonding.

2. Provide grounding, surge protection and lightning protection of telecommunications system in accordance with latest version of Grounding, Bonding and Electrical Protection chapter of the BICSI TDM Manual, TIA/EIA 607, and NFPA 70.

3. Conform to all telecommunications grounding and bonding details and riser diagrams included within the drawings.

F. Wall phone boxes shall be spaced 10” away from any sidewall, corner, doorjamb or adjacent box.

3.02 TESTING, HORIZONTAL CABLING

A. Horizontal cabling testing shall be conducted from the jack at the outlet in the Work Area to the Patch Panel on which the cables are terminated.

B. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing. Test adapter cable must be approved by the manufacturer of the test equipment.

C. All horizontal cables must be tested with a Level 3 Fluke DTX Networks Cable Tester.

D. Testing of the Permanent Link shall be performed. However, contractor shall warrant performance based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

E. Horizontal station cables shall be free of shorts within the pairs, and be verified for continuity, pair validity, and polarity, and Wire Map (Conductor Position on the Modular Jack). Any defective, split or miss-positioned pairs must be identified and corrected.

F. Testing of the Cabling Systems rated at TIA Category 6/6A and above shall be performed to confirm proper functioning and performance.

G. Testing of the Transmission Performance of station cables (Category 6/6A) shall include:

1. Length
2. Attenuation
3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss (Equal Level Far End Cross-Talk)
8. PSEFEXT Loss
9. Propagation Delay
10. Delay Skew
11. Return Loss

H. The maximum length of horizontal cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

I. Cables shall be tested to the maximum frequency defined by the EIA/TIA 568B standards covering that performance category. Test records shall verify a “PASS” on each cable and display the specified parameters – comparing test values with standards based “templates” integral to the unit.

J. Any “Pass*” or “Warning” test results shall be considered a “FAIL” for the channel or permanent link under test. In order to achieve an overall “Pass Condition”, the test result for each individual test parameter shall be “PASS”.

K. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1MHz to the highest relevant frequency, using a swept frequency interval consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations. And in both directions when required by the appropriate standards.

3.03 DOCUMENTATION

A. At the completion of the project and prior to system acceptance provide the following documentation:

1. As-built floor plans that show the final location and identification of the telecom outlets. Submit the floor plans in printed form and as AutoCAD 2010 files (Original AutoCAD files will be made available).

2. Test results for each strand of fiber optic cable installed. This should be supplied in a page per strand printed format and in machine-readable (computer file) format. If the machine-readable file requires special software for reading, a single-user version of that software shall be provided as well.

3. Test results for each pair of copper riser cabling installed and the installed cable length.

4. Test results for each UTP station cable installed. This should be supplied in a page per cable printed format and in machine-readable (computer file) format. If the machine-readable file requires special software for reading, a single-user version of that software will be provided as well.
5. Test results for each coaxial riser and horizontal cable installed. Documentation indicating successful testing and length for each cable shall be bound and provided by the vendor.

6. Cross connection documentation for the voice station cable (cut sheets) which detail the station number, telecom room, and riser pair number for each installed cross connection.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sound System Equipment.
   2. Audiovisual Cabling for in-wall applications.
   3. Audiovisual patch cords.
   4. Audiovisual connectors.
   5. Extenders and HDBASE-T equipment.

B. Related Sections:
   1. Division 01 – General Requirements
   2. Section 26 0400 – General Conditions for Electrical Trades.
   5. Section 27 0553 – Identification for Communications Systems.
   6. Section 27 1000 – Structured Cabling (for Ethernet cable requirements).

1.02 REFERENCES

A. All wire and components supplied shall meet the requirements of the following and all sub-referenced documents:
   1. The National Electrical Code, Article 800.
   2. Underwriters Laboratories (UL).
   3. EIA/TIA 568-B.

B. Work included in these specifications is to be performed within the parameters of the following standards:
   1. AES (Audio Engineering Society)
   2. ASTM (American Society of Tests and Measurements.
   3. IEEE (Institute of Electrical and Electronic Engineers)
   4. NAB (National Association of Broadcasters)
   5. NEC (National Electrical Code)

1.03 SYSTEM DESCRIPTION

A. This Specification establishes the requirements necessary to achieve the intended performance and function of the Audio-Video System(s) described herein. Therefore, all materials and labor that are specified are necessary to meet these requirements. It includes materials and labor required to provide a complete and operable system(s) as specified herein and shown with the Audio-Video Systems drawings.
B. It is understood and agreed by the project contractor that the systems described herein shall be completed in every detail necessary to supply a complete, working system(s) implemented in a professional manner.

C. This text as well as the provided drawings are only necessary to define the design intent and anticipated performance requirements. Equipment not discreetly mentioned or outlined in these documents shall be provided without claim for additional payment.

D. Drawings included with this document shall be considered part of this specification. The Contractor will provide complete and operating system(s) including all labor and materials for all assemblies and sub-assemblies either specified or implied within this project document.

1. Equipment function and features are to be provided by the Contractor. Where a specific item is listed by manufacturer’s name and product number it identifies a minimum requirement for performance parameters and functionally defined by the product. This is not only limited to the device specified but also by the manufacturer’s warranties.

2. If a Contractor intends to provide goods other than those specified, such as “an equivalent” device it must clearly be documented within the bid response. Proposed “equivalent” items must include a written certification from the manufacturer of the replaced item stating the equivalency of each item in regard to features, function, performance, and future system capabilities.

3. A contractor wishing to substitute items with an equivalent product must be willing to demonstrate the equivalency of said item to the owner and owner’s representative at the contractor’s expense. This proof of equivalency, in addition to the manufacturer’s letter may include the following.
   a. “On-Site” side by side demonstration of both the specified unit and the proposed equivalent item.
   b. Independent laboratory test report. This is to include spreadsheet comparison of all critical distortion, frequency response, dynamic range, and power requirements. All tests based upon current AES standards.
   c. Equipment costs for proposed substitution items shall be listed showing the owner or owner’s representative a cost savings incurred with the use of said proposed item.
   d. Contactor costs incurred, travel expenses, and other related costs shall be incurred by the contractor.
   e. Any professional services, service fees of engineers, consultants, or architects as a result of time being expended during this review, charged to the owner, shall be reimbursed to the owner by the contractor and/or his sub-contractor.

E. Provide all audiovisual patch cables to establish complete systems to the end-user level.
F. The audiovisual cable raceway systems consist of the following:
   1. The Metallic Conduit System is a network of empty conduits into which the Audiovisual Contractor shall install the cables for the audiovisual system.

G. Unless specifically called out otherwise, all audiovisual system wiring listed in the audiovisual schedule of terminations shall be run in metallic conduit.

1.04 SUBMITTALS:

A. Submit under provisions of Division 01.

B. Submittals shall include a complete “Bill of Material” by each sound system area. This shall include all components required to complete an operational system. Each item shall include the following:
   1. Quantity of device(s)
   2. Manufacturer’s current model number
   3. Manufacturer’s name
   4. Item description

C. CAD produced drawings shall be included with package. These shall include, but not be limited to, the following:
   1. All systems showing general wiring.
   2. All System(s) signal path, as a one line riser.
   3. Any and all custom manufactured panel assemblies.
   4. Equipment Cabinet Risers

D. List a minimum of four completed project references similar to the scope of this project. Include project name, location, and contact names of references.

E. Provide a statement from the major manufactures showing the sound contractor is an authorized representative of that product. This is to insure products are current, recall notices are acknowledged, and correct programming/installation methods are employed as recommended by the manufacture.

F. Include a list of testing equipment owned by the Audio-Video contractor.

G. Warranty Information: The vendor is required to submit, with this bid, specifications describing the standard warranty for all proposed cable and hardware.

H. The Electrical Contractor shall submit a conduit riser diagram for all audiovisual system wiring.

1.05 CLOSEOUT SUBMITTALS

A. Division 01– General Requirements.

B. Project Record Documents: Record actual locations of all input and output stations for display devices.
1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum THREE YEARS documented experience.

B. Installer: Company specializing in installing products specified in this section with minimum three years documented experience.

C. Provide a full time, on-site Project manager to supervise the project.

D. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

E. Pre-approved audiovisual integrators/installers are as follows:
   1. RnB Enterprises, Inc.; Newtown, CT
   2. HB Communications; North Haven, CT
   3. Integrated Technical Systems, Inc.; Wallingford, CT
   4. Environmental Systems Corporation; West Hartford, CT
   5. ATC Audio; Springfield, MA

1.07 PRE-INSTALLATION MEETINGS

A. A minimum of one contractor meeting will be required with the owner or owner’s representative to review the scope of project. The intent of this is to review submittals, proposed construction, proposed installation, and to coordinate sound system(s) installation with other trades.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and product in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.09 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

1.10 WARRANTY

A. Contractor’s Warranty: Warranty the installation to be free of defect for a period of two (2) years.

B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer’s warranty.
PART 2 PRODUCTS

2.01 GENERAL

A. Manufactured Products:
   1. All items provided by contractor shall be current models and “brand new” in manufacture.
   2. Demonstration models, tested equipment, or previously used items will not be accepted.
   3. Any item that is obsolete shall be identified to owner or owner’s representative.
   4. Owner or owner’s representative reserves the right to accept or decline any proposed equipment substation.

B. Custom Manufactured Items:
   1. All custom fabricated items are to be submitted in CAD format with submittal package and subject to the approval of the owner or owner’s representative. Contractor is responsible for incurring costs if samples of fabricated panels are requested. Custom made panels are to be new in origin and made to order for this specific project.

2.02 SOUND SYSTEM EQUIPMENT

A. Components for each sound system shall be provided as indicated on drawings. Each sound system riser diagram lists quantity, manufacturer, and model number of each component required for that specific sound system.

B. Acceptable manufacturers:
   1. Speakers: Bose, JBL, Meyer Sound
   2. Microphones: Shure, Sennheiser, Samson
   3. Controllers: Bose, BSS Audio, AtlasIED
   4. Rack Mixers: Shure, Samson, Yamaha
   5. Console Mixers and I/O Boards: Allen & Heath, Roland, Yamaha
   6. Media Players: Denon, Tascam, Marantz
   7. Recorders: Denon, Tascam, Elation
   9. Intercom: Telex, Clearcom, AtlasIED
   10. Rack Equip: Middle Atlantic, AtlasIED, Hoffman
   11. Power Equip: Middle Atlantic, AtlasIED, TrippLite
   12. ADA Equip: Listen Audio
   13. Substitutions: Division 01 – Product Requirements

C. Custom panels shall be engineered and manufactured by ProCo/Rapco, or equal.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees. Said modifications shall
include, but not be limited to, changes to 120VAC power outlets, conduits, backboxes, data cabling, infrastructure and other required pathways.

2.03 AUDIOVISUAL CABLEING

A. Manufacturers:
   1. Legrand
   2. Extron
   3. FSR
   4. Belden
   5. Crestron

B. Passive HDMI cable:
   1. Basis of Design model numbers:
      a. Legrand/C2G 50612: 15 ft High Speed HDMI Cable.
   2. Provide this system where indicated on the drawings, and where HDMI cabling is 15 feet or less in length.
   3. Passive HDMI cables shall not require power for transmission and shall support the specification listed herein without a power supply.
   4. Passive HDMI cables shall be provided with a compatible pass-through HDMI 2.0 connector/keystone mounted in a faceplate on both the source and display ends of the run. The connector shall be by the same manufacturer as the cable and shall be approved by the cable manufacturer to support the specifications listed herein, with minimal signal degradation.
   5. Active HDMI cables shall meet or exceed the following specifications:
      a. CL2-rated jacket for in-wall installations.
      b. Supports resolutions up to 4096x2160 at 60 Hz 4:4:4 (Full 4K), including 3D and dual video streams (Dual View).
      c. Data speeds up to 18.0Gbps.
      d. Supports full HD Blu-ray and HD DVD video.
      e. Supports 8, 10, 12, and 16 bit per channel deep color.
      f. Supports up to 32 audio channels and a 1536kHz audio sampling rate.
      g. Supports DTS-HD Master Audio™, Dolby TrueHD™, DTS, Dolby AC3 & DSD Audio.
      h. Supports extended CEC (Consumer Electronics Control) commands and functions, HDMI Ethernet Channel (100 Mbits/s) and ARC (Audio Return Channel).
      i. Type “A” male HDMI pre-terminated connectors on both ends.

C. USB cables shall meet or exceed the following specifications:
   1. Version “3.0”.
   2. A-A or A-B type, as indicated on drawings.
   3. 24 / 28 AWG copper conductors.
   4. Up to 4.8 Gbps bandwidth.

D. Stereo audio cables shall meet or exceed the following specifications:
   1. 3.5mm type
2. Shielded
3. Tip-ring-sleeve
4. Fully molded connector with strain relief

E. All cables shall be factory-supplied with connectors as indicated on drawings.

F. All cables shall be rated for in-wall applications.

2.04 AUDIOVISUAL CONNECTORS

A. Connectors from the following manufacturers shall be considered acceptable. Install connectors appropriate for the installed cable and equipment interface. Use appropriate tooling as specified by the connector manufacture to install the connectors.
1. Legrand
2. Hubbell
3. Tripp-Lite
4. Extron
5. FSR

B. HDMI connectors:
1. Description: HDMI 2.0 feed-through keystone.
2. Approved and recommended for use with the associated HDMI cable (passive or active), as noted in above paragraph.

C. USB connectors:
1. Description: USB 3.0 A-A feed through keystone.

D. Stereo audio (3.5mm) connectors:
1. Description: 3.5mm screw terminal.

E. Provide all necessary mounting accessories, faceplates and keystones for a complete installation.

F. Blank spaces in audiovisual faceplates shall be filled with blank connector components, Hubbell iStation SFB10 or equal.

2.05 EXTENDERS AND HDBASE-T EQUIPMENT

A. Manufacturers:
1. Crestron
2. Hubbell
3. Extron

B. System description: Audio-video equipment for the purpose of extending multiple signals over a single Cat.X cable.

C. Refer to drawings for model numbers and additional product requirements.
D. At a minimum, all extenders shall meet the following general specifications:
2. Support USB 3.0 capability.

E. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees. Said modifications shall include, but not be limited to, changes to 120VAC power outlets, conduits, backboxes, data cabling, infrastructure and other required pathways.

PART 3 EXECUTION

3.01 INSTALLATION – GENERAL

A. Prior to installation, the Electrical Contractor shall submit a riser diagram for all audiovisual system conduit.

B. No installation work shall proceed until the conduit riser has been approved, in writing, by the Electrical Engineer.

C. All lines installed in conduits shall be splice free. Cabling shall be free from installation damage.

D. All connector wiring shall be by rosin core solder joints. No push on type connectors shall be accepted.

E. All cables to be numbered and identified in “As Built Documents”. Provide permanent cable identification.

F. Project shall be adequately staffed at all times. Coordination with other trades and cooperation is mandatory.

3.02 INSTALLATION – EQUIPMENT

A. All material and equipment to be new and unused.

B. Provide adequate ventilation for all active electronic equipment.

C. All equipment shall be installed without dents, scratches, free of marks and blemishes.

D. The contractor is responsible for all tuning, programming, setup and configuration of all audiovisual systems.
3.03 INSTALLATION - WIRE GROUPS IN CONDUIT

A. All audiovisual wiring shall be installed in conduit.

B. Minimum conduit diameters and diagrammatic routing of audiovisual conduits are indicated on drawings.

C. The actual diameter and path of each conduit run shall be determined by the Electrical Contractor in accordance with field conditions.

D. Should the Electrical Contractor choose to combine cable runs from individual terminations into a common conduit, then they must conform to the wire grouping, conduit fill, and conduit separation requirements listed in this Section.

E. To prepare the required conduit riser diagram, the Electrical Contractor must group cables by wiring type; determine the total number of cables in each conduit run; determine the diameter of each conduit run; determine the actual routing of each conduit run.

F. Refer to Paragraph 3.4 of this Section for wiring group and conduit separation requirements.

G. Refer to Table 5 at the end of this Section for audiovisual cable specifications and conduit capacities.

3.04 INSTALLATION - CONDUIT SEPARATION

A. Audiovisual system wiring is divided into separate groups according to their nominal voltage levels. These wiring groups must never be intermixed within a given conduit run. See Table 2 at the end of this Section for wire type information.

B. Conduits carrying audiovisual wiring must maintain a minimum separation from conduits carrying other types of audiovisual wiring. When necessary, ninety degree crossings in close proximity are acceptable. See Table 3 at the end of this Section for audiovisual conduit separation requirements.

C. Conduits carrying audiovisual wiring must maintain a minimum separation from conduits carrying other types of electrical wiring. Unusually heavy current demands in; or long parallel runs with; electrical services may dictate greater separations to avoid interference with the audiovisual system. See Table 4 at the end of this Section for electrical conduit separation requirements.

3.05 INSTALLATION - METALLIC CONDUIT SYSTEM

A. The metallic conduit system is specified by information called out in the large-format audiovisual system drawings:
   1. The location drawings indicate the position of each audiovisual device and the method of mounting each device.
a. The schedule of terminations lists each audiovisual device; indicates the quantities, types, and groupings of all cables connected to each device; and lists the destination for all cables exiting each device.

B. Refer to Table 5 at the end of this Section for audio cable specifications and conduit sizing requirements.

C. In most cases, each run of this conduit system shall be bonded to the audio termination back boxes which are provided by the Audiovisual Contractor. The only exception is conduit which is routed to the audio equipment racks. Conduit runs entering or exiting the audio equipment racks shall be electrically isolated from the racks. PVC or other non-conductive fittings shall be used to isolate the conduit from the audiovisual equipment racks.

D. Provide all empty conduits with pull lines.

3.06 INSTALLATION - CABLE SLEEVES

A. Install per architectural detail drawings with threaded cap at each end of sleeve. These caps shall be lubricated for easy removal and held captive by a chain.

3.07 TESTING

A. Each cable and equipment manufacturer shall factory-test their respective products being installed on this project and provide test reports at time of delivery. Provide separate, respective test reports, indicating that products meet or exceed the latest applicable TIA/EIA Standards and technical bulletins.

B. All other products relative to this specification shall be tested to their respective industry’s strictest standards.

C. Each manufacturer shall factory-test their respective cable or equipment provided to this project at several lower frequency levels, including the minimum and maximum frequency level indicated herein. The test reports shall indicate test results for at least five equal incremental frequency levels, including the maximum required.

D. Presentation Systems: Verify the functionality of each installed system. Verify that connectors are properly installed and where appropriate, screwed down. Cable shall be neatly dressed and tied back. Tag cable with permanent markers indicating the function of each cable. Adjust and balance audio systems to provide a minimum of 85db/spl at the average listening position. System testing shall be coordinated with the Owner’s representative.

3.08 SOUND SYSTEM TESTING

A. Provide all necessary test equipment required for proper facilities testing as outlined below. Adjust levels, frequency attenuators, and matching devices to achieve system performance.
GRANBY MEMORIAL HIGH SCHOOL
GRANBY, CT

B. Impedance and Phase
1. Check all microphone lines for proper polarity, make all lines uniform.
2. Check all line level paths for proper polarity, make all lines uniform.
3. Check all speaker line paths for proper polarity, make all lines uniform.
4. Measure and record all installed speaker lines, at audio equipment rack, for proper impedance. Document all measurements.
5. Check for proper polarity of all installed speakers, or speaker components.
6. Make any and all required changes to provide correct operation of above.

C. Hum and Noise
1. All Hum and Noise shall be inaudible under normal operating conditions. Corrections must be completed prior to any further testing. Measurable signal from microphone input to power amplifier shall be greater than -70 dB and greater than 80 dB for line levels.

D. RF Interference and Oscillations
1. Systems shall be free from any external RF interference or noise. Using a 10 MHz or greater oscilloscope measured system to insure no audible, sub sonic or ultra sonic noise is present.

E. Buzzes, Rattles, and Distortion
1. The sound system shall be free of any rattling, mechanical noises, or distortion caused by improper installation. In addition, if under testing it is discovered that external noises are cause from other trades related to this installation or not, it must be brought to the attention of the owner or owner’s agent.

F. Acoustical Measurements
1. A Real Time Audio Spectrum Analyzer shall be used with a pink noise source to complete the required testing. A field technician trained in use of this machine is required. All acoustical testing shall be completed after all interior finishes have been done.
2. Frequency Response shall be flat from 60 Hz to 4K Hz + or – 4 dB including no peaks outside of this parameter. Roll off above the outlined range shall be at 3 dB per octave from the 4K Hz to 12.5K Hz. The Real Time Analyzer shall be placed in a minimum of 6 locations to comply with above frequency curves.
3. Coverage shall be uniform. Using a pink noise source, measurement shall be taken at the above 6 locations and at an additional 6 random points. Level shall be uniform within 6 dB.

G. Listening Test
1. May include surveys and subjective testing of intelligibility at random locations under operating conditions. Testing will include live voice quality, recorded speech playback, program playback, and playback of locally recorded program within system.

AUDIO-VIDEO SYSTEMS
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PROJECT No. 056-0052 A / 01/07/2022
3.09 DOCUMENTATION

A. Provide copies of all manuals and two (2) sets of as-built documents, in hard copy and electronic format. As-built documentation shall include location and types of hardware provided and installed as well as the interconnection of each device.

3.10 TRAINING:

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner’s personnel with the installation, equipment, and maintenance.

B. Provide training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

C. Duration of Training: Per Section 260400.

3.11 REFERENCE TABLES

TABLE 1 - PROJECT WORK SCOPE

<table>
<thead>
<tr>
<th>ITEMS TO BE PROVIDED AND INSTALLED</th>
<th>Electrical Contractor</th>
<th>Audiovisual Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Provides</td>
<td>Installs</td>
</tr>
<tr>
<td>Audiovisual Equipment Racks and Devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Metallic Conduit between Audiovisual Devices and Audiovisual Equipment Racks</td>
<td>x</td>
<td>x◊</td>
</tr>
<tr>
<td>2. Conduit Insulation Bushings between Metallic Conduit and Audiovisual Equipment Racks</td>
<td>x</td>
<td>x◊</td>
</tr>
<tr>
<td>3. Audiovisual Equipment Rack Cabling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Audiovisual Equipment Rack Terminations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Audiovisual Device Back Boxes and Floor Boxes</td>
<td>x◊</td>
<td>x</td>
</tr>
<tr>
<td>6. Audiovisual Device Metallic Conduit</td>
<td>x</td>
<td>x◊</td>
</tr>
<tr>
<td>7. Audiovisual Device Cabling</td>
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<td></td>
</tr>
<tr>
<td>8. Audiovisual Device Termination</td>
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<td></td>
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<tr>
<td>Audiovisual Cable Sleeves</td>
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<td>x</td>
</tr>
<tr>
<td>Audiovisual Pull Boxes</td>
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<td>x</td>
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<tr>
<td>Conduit Riser Diagram</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

◊ Installation criteria to be provided by Audiovisual Contractor

TABLE 2 - AUDIOVISUAL WIRING TYPES
Audiovisual system wiring is divided into wiring groups according to their nominal voltage levels:

<table>
<thead>
<tr>
<th>Wiring Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A: Microphones and other sensitive wiring (0 mV to 100 mV)</td>
</tr>
<tr>
<td>Group B: Line level wiring (100 mV to 10 V)</td>
</tr>
<tr>
<td>Group C: Loudspeaker and control wiring (10 V to 70 V)</td>
</tr>
<tr>
<td>Group D: Telephone, video, control and digital circuits (including Category</td>
</tr>
<tr>
<td>Structured cabling for data)</td>
</tr>
<tr>
<td>Group E: Fiber optic cable</td>
</tr>
</tbody>
</table>

Note: These wiring groups must never be intermixed within a given conduit run!

**TABLE 3 - AUDIO CONDUIT SEPARATION**
Minimum conduit separation between conduits carrying wiring of different audiovisual groups is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Group E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>adjacent</td>
<td>6&quot;</td>
<td>12&quot;</td>
<td>12&quot;</td>
<td>adjacent</td>
</tr>
<tr>
<td>Group B</td>
<td>-</td>
<td>adjacent</td>
<td>12&quot;</td>
<td>6&quot;</td>
<td>adjacent</td>
</tr>
<tr>
<td>Group C</td>
<td>-</td>
<td>-</td>
<td>adjacent</td>
<td>6&quot;</td>
<td>adjacent</td>
</tr>
<tr>
<td>Group D</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>adjacent</td>
<td>adjacent</td>
</tr>
<tr>
<td>Group E</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>adjacent</td>
</tr>
</tbody>
</table>

Note: Ninety degree crossings in close proximity are acceptable.

**TABLE 4 - ELECTRICAL CONDUIT SEPARATION**
Minimum conduit separation between conduits carrying audiovisual wiring and other electrical service conduit is as follows:

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Group E</th>
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</thead>
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<tr>
<td>Dimmer controlled lighting</td>
<td>24&quot;</td>
<td>12&quot;</td>
<td>6&quot;</td>
<td>12&quot;</td>
<td>adjacent</td>
</tr>
<tr>
<td>SCR controlled services</td>
<td>24&quot;</td>
<td>12&quot;</td>
<td>6&quot;</td>
<td>12&quot;</td>
<td>adjacent</td>
</tr>
<tr>
<td>220/440VAC circuits</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>adjacent</td>
<td>adjacent</td>
<td>adjacent</td>
</tr>
<tr>
<td>All other services</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>adjacent</td>
<td>adjacent</td>
<td>adjacent</td>
</tr>
</tbody>
</table>

Note: Heavy current demands in or long parallel runs with the above services may dictate greater separations to avoid interference with the audiovisual systems.

**TABLE 5 - CONDUIT SIZING FOR AUDIO CABLES**
<table>
<thead>
<tr>
<th>Mfr</th>
<th>Type</th>
<th>OD</th>
<th>Area</th>
<th>3/4”</th>
<th>1”</th>
<th>1-1/4”</th>
<th>1-1/2”</th>
<th>2”</th>
<th>2-1/2”</th>
<th>3”</th>
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<tbody>
<tr>
<td>Belden</td>
<td>1351A</td>
<td>0.290</td>
<td>0.066</td>
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<td>9</td>
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<td>Belden</td>
<td>1502R</td>
<td>0.250</td>
<td>0.049</td>
<td>4</td>
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<td>4</td>
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<td>10</td>
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<td>0.043</td>
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<td>14</td>
<td>19</td>
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<td>54</td>
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<td>1700A</td>
<td>0.200</td>
<td>0.031</td>
<td>7</td>
<td>11</td>
<td>19</td>
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<td>43</td>
<td>75</td>
<td>113</td>
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<td>Belden</td>
<td>2412</td>
<td>0.220</td>
<td>0.038</td>
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<td>9</td>
<td>15</td>
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<td>0.770</td>
<td>0.466</td>
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<tr>
<td>Belden</td>
<td>7712A</td>
<td>0.970</td>
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<td>0</td>
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<td>2</td>
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<td>Belden</td>
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<td>5</td>
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<td>10</td>
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<td>Belden</td>
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<td>0.029</td>
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<td>28</td>
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<td>0.073</td>
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<td>5</td>
<td>8</td>
<td>11</td>
<td>18</td>
<td>32</td>
<td>48</td>
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<td>Belden</td>
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<td>0.185</td>
<td>0.027</td>
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<td>22</td>
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<td>Belden</td>
<td>8465</td>
<td>0.282</td>
<td>0.062</td>
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<td>Belden</td>
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<td>0.030</td>
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Note: Minimum conduit size allowed for audio cables is 3/4 inch.

END OF SECTION

AUDIO-VIDEO SYSTEMS
27 41 00 - 14
PROJECT No. 056-0052 A / 01/07/2022
PART 1 GENERAL

1.01 SUMMARY

A. Supply and install new speakers, amplifiers and interface devices connected to an existing public address system.

B. Related Sections:
   1. Division 01 – General Requirements
   2. Section 26 0400 – General Conditions for Electrical Trades
   5. Section 27 0553 – Identification for Communications Systems.
   6. Section 27 5313 – Clock Systems.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. Underwriters Laboratories (UL).

C. EIA/TIA 568-B.

1.03 SYSTEM DESCRIPTION

A. Supply and install new speakers, amplifiers and interface devices connected to an existing public address system.

B. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, wiring, speakers, and all other necessary equipment to provide a complete operating system as indicated with the contract documents. Provide all necessary wall plates, specialty boxes, etc.

C. The Communication System shall provide distribution of intercom, overhead paging, emergency paging, tones, program material, AND on board emergency messaging.

D. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.

E. Furnish additional items not mentioned herein to meet requirements as specified, to include hardware, rack panels, 66Blocks etc., and other devices that are required for installation.
F. Labor furnished shall be trained and experienced in telecommunication systems.

G. All equipment unless otherwise specified, shall be new, free from defects, and the best craftsmanship in its class.

H. All manufactured equipment shall be installed as recommended by the manufacturers, or as indicated in their published installation manual.

I. Furnish and install necessary equipment, backboxes, supports and enclosures.

J. Furnish and install all necessary wire.

K. Perform initial programming of system and audio level adjustments.

L. Perform final programming of system and audio level adjustments.

M. Provide information on system requirements to any Contractor responsible for supplying related materials for this system.

N. System must be U.L. 813 and FCC Part 15 listed for safety reasons. Systems not listed as above shall not be acceptable.

1.04 SUBMITTALS

A. See Division 01 - General Requirements.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

C. Product Data: Provide data showing electrical characteristics and connection requirements for each component.

D. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate that installation is complete and system performs according to specified requirements.
1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and Federal Communications Commission.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 CLOSEOUT SUBMITTALS

A. Division 01– General Requirements

B. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors.

C. Operation Data: Include instructions for adjusting, operating, and extending the system.

D. Maintenance Data: Include repair procedures and spare parts documentation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.08 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

B. Coordinate installation of wall mounted speakers with installation of clocks, described in Section 27 5313.

1.09 WARRANTY

A. Contractor’s Warranty: Warranty the installation to be free of defect for a period of two (2) years.
B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer’s warranty.

PART 2 PRODUCTS

2.01 PUBLIC ADDRESS SYSTEM

A. Rauland-Borg Telecenter ICS (existing to remain).

B. All new speakers and related accessories shall be compatible with the existing Rauland-Borg system. Provide all interface modules, amplifiers, power supplies, expansion modules, and other devices required to integrate new speakers indicated on drawings with existing public address system. The existing system is wired at 70V Distributed Voltage.

2.02 LOUDSPEAKERS

A. Wall Mounted Loudspeakers:
   1. The speaker shall be a Bogen Model MB8TSLVR or approved. The unit shall include an 8" paper cone speaker with 6 oz. magnet. The frequency response shall be 110 Hz to 15 kHz. Dispersion angle shall be no less than 100°. Sensitivity, measured 1 watt @ 1 meter on axis, shall be a minimum of 96 dBspl. The unit shall incorporate a transformer with tap selection wires corresponding to power settings of 4, 2, 1, 1/2, 1/4, and 1/8 watts for both 70V and 25V constant voltage speaker systems. Speaker shall have a recessed volume control centered in the front speaker grille. The speaker enclosure shall be full steel construction and allow for surface mounting. The enclosure shall be painted off-white and measure 11-5/8"W X 11-5/8" H X 4-1/4" D. Front face shall be angled by 12.5 degrees downward. Product weight shall be 9 lb.

B. Ceiling Mounted Loudspeakers:
   1. The speaker shall be a Bogen Model CSD2X2VR Drop-In Ceiling Speaker, which shall be fully enclosed and constructed of industrial grade steel. It shall be comprised of a damped high-compliance factory-mounted 8" loudspeaker that shall consist of an 8" treated paper main cone, a secondary high frequency cone, and a 10 ounce magnet. The unit shall have a 70V/25V transformer with power taps of 4, 2, 1, 0.5, and 0.25 watts, selectable by rotary switch. Output shall be 94 dB @ 1 watt / 1 meter (min.). Frequency response shall be 95 Hz to 20 kHz (min.). The speaker shall include 4 seismic attachment points. The speaker shall have a non-reflective, off-white or bright white ("U" versions) metal finish grille. Speaker is listed to UL Standard 1480 for U.S. use. Speaker shall be equipped with a front-accessible volume control knob. The speaker assembly will fit into 2' x 2' and 2' x 4' ceiling tiles. For 2' x 2' installations, a support rail shall not be needed and no cuts to the ceiling shall be necessary. For 2' x 4' installations, a single cut to the ceiling tile and an included support rail shall
be provided. The speaker shall measure 24" W x 4-7/8" H x 24" D and shall weigh 12 lb.

2.03 WIRE AND CABLE

A. Plenum Cable for Speaker Circuits: Unless otherwise noted on drawings, provide 22 AWG copper conductor, 300 volt insulation, rated 200 degrees C, paired conductors twisted together shielded and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mounting Heights:
   1. Wall mounted interior speaker: 6" below ceiling/structure unless otherwise noted on drawings.

C. Splice cable only in accessible junction boxes or at terminal block units.

D. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

E. Install input circuits in separate cables and raceways from output circuits.

F. Leave 18 inches (300 mm) excess cable at each termination at microphone, volume pad, speaker, and other system outlet.

G. Provide protection for exposed cables where subject to damage.

H. Use armored cable for outside speaker circuits.

I. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

J. Use suitable cable fittings and connectors.

K. Connect reproducers to amplifier with matching transformers.

L. Install equipment racks in location shown; arrange to provide adequate ventilation and access.

M. Ground and bond equipment and circuits in accordance with Section 26 0526.

N. Configure the paging system with an all-call with priority override.
At each speaker location, form a four (4) foot coil of slack cable prior to each termination point. In the telecom closet, form a ten (10) foot coil of slack cable prior to termination point. Tag and identify cable by means of firm, visible machine labels at the originating end and at each speaker termination. Mount the amplifiers and control unit on a backboard located in the primary telecom closet. The vendor shall be responsible for system activation, interface with the telephone system, local public address systems (for override) and system balancing. Provide 66-blocks adjacent to head-end rack for termination of speaker cabling. Provide amphenol cables to connect 66-blocks to head-end amplification equipment.

3.02 TESTING

A. Upon completion of the system installation, align, adjust and balance the system. Determine that the system conforms to the requirements of the Drawings and specifications. Correct all deficiencies and replace malfunctioning or damaged items. Repeat testing until all materials and equipment perform satisfactorily and the system requirements are achieved.

B. Provide a written record of test results to the owner within 10 days of the completion of these tests.

C. Provide all necessary test equipment required for proper facilities testing as outlined below. Adjust levels, frequency attenuators, and matching devices to achieve system performance.

D. Impedance and Phase
   1. Check all speaker line paths for proper polarity, make all lines uniform.
   2. Measure and record all installed speaker lines, at audio equipment rack, for proper impedance. Document all measurements.
   3. Check for proper polarity of all installed speakers, or speaker components.
   4. Make any and all required changes to provide correct operation of above.

E. Hum and Noise
   1. All Hum and Noise shall be inaudible under normal operating conditions. Corrections must be completed prior to any further testing.

F. Buzzes, Rattles, and Distortion
   1. The sound system shall be free of any rattling, mechanical noises, or distortion caused by improper installation. In addition, if under testing it is discovered that external noises are cause from other trades related to this installation or not, it must be brought to the attention of the owner or owner’s agent.

G. Acoustical Measurements
   1. A Real Time Audio Spectrum Analyzer shall be used with a pink noise source to complete the required testing. A field technician trained in use of this machine is required. All acoustical testing shall be completed after all interior finishes have been done.
2. Frequency Response shall be flat from 60 Hz to 4K Hz + or – 4 dB including no peaks outside of this parameter. Roll off above the outlined range shall be at 3 dB per octave from the 4K Hz to 12.5K Hz. The Real Time Analyzer shall be placed in a minimum of 6 locations to comply with above frequency curves.

3. Coverage shall be uniform. Using a pink noise source, measurement shall be taken at the above 6 locations and at an additional 6 random points. Level shall be uniform within 6 dB.

H. Listening Test
1. May include surveys and subjective testing of intelligibility at random locations under operating conditions. Testing will include live voice quality, recorded speech playback, program playback, and playback of locally recorded program within system.

3.03 DOCUMENTATION
A. Provide copies of all manuals and two (2) sets of as-built documents, in hard copy and electronic format. As-built documentation shall include location and types of hardware provided and installed as well as the interconnection of each device.

3.04 TRAINING:
A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.

B. Provide training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

C. Duration of Training: Per Section 260400.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section includes additional wireless clocks connected to an existing system.

B. Related Sections:
   1. Division 01 – General Requirements
   2. Section 26 0400 – General Conditions for Electrical Trades
   5. Section 27 0553 – Identification for Communications Systems.

1.02 REFERENCE STANDARDS (follow the most currently adopted amended version)

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction.

B. Underwriters Laboratories (UL).

C. EIA/TIA 568-B.

1.03 SYSTEM DESCRIPTION

A. Description: Synchronized wireless master-satellite time System to include master clock system controller, GPS antenna, transmitters and wireless (communications) secondary clocks. System establishes time standard signal for:
   1. Indicating clocks.
   2. Time period audible and visual signals.

B. Equipment and components furnished shall be of manufacturer’s latest model.

1.04 SUBMITTALS

A. See Division 01 - General Requirements.

B. Shop Drawings: Indicate wiring diagrams and interconnection diagrams. Submit project-specific riser diagram with locations and quantities of clocks and head-end devices.

C. Product Data: Provide for each item of equipment; show specified ratings, colors, finishes, and physical dimensions.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and Federal Communications Commission.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

D. Installer Qualifications: Authorized installer of specified manufacturer.

E. Products: Listed, classified, and labeled as suitable for the purpose intended.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 CLOSEOUT SUBMITTALS

A. Division 01 – General Requirements

B. Project Record Documents: Record actual locations of clocks.

C. Operation Data: Operating instructions.

D. Maintenance Data: Maintenance and repair instructions.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.08 COORDINATION

A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

B. Coordinate installation of wall mounted clocks with installation of speakers, described in Section 27 5116.
1.09 EXTRA MATERIALS
   A. Provide two(2) clocks as attic stock.

1.10 WARRANTY
   A. Contractor’s Warranty: Warranty the installation to be free of defect for a period of two (2) years.
   B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer’s warranty.

PART 2 PRODUCTS

2.01 WIRELESS MASTER CLOCK
   A. Existing Sapling SMA3000 wireless master clock to remain.
   B. All new secondary clocks and related accessories shall be compatible with the existing Sapling wireless system. Contractor is responsible for furnishing and installing new power supplies, repeaters, expansion modules and other accessories as recommended by manufacturer to support the new wireless secondary clocks specified on Drawings.

2.02 WIRELESS SECONDARY CLOCKS
   A. The secondary clock shall be a Sapling SAL Series wireless clock. It shall be an analog clock with a black hour hand, a black minute hand, and a red second hand. The clock will be capable of receiving and then re-transmitting a signal from any other Sapling device that transmits data using Sapling’s wireless protocol. The clock shall use frequency-hopping technology to receive time data on a frequency range of either 915–928 MHz or 2.4GHz, depending on the type of transmitter that was ordered. The clock shall also be able to retransmit time data on the same frequencies: either 915-928MHz or 2.4GHz, depending on the type of transmitter that was ordered. The frequency-hopping technology shall allow the clock to transmit time data without causing interference to other wireless devices that may be transmitting at the same time. The clock shall be designed to be used with the Sapling SMA Series Master Clock (with the transmitter option installed) or the Sapling Repeater. Time data shall be transmitted and received by the clock via Sapling’s wireless communication protocol. The clock shall also be designed to receive and retransmit time data to Sapling’s SBL(G**) Series clocks and other SAL(G) Series clocks. Upon receipt of the wireless signal, the clock will immediately self–correct. The clock’s transmitter shall be able to successfully transmit data over a line-of-sight, unobstructed distance of up to 1320 feet (402 meters). The clock shall include an executable method for automatic hand calibration, as well as a diagnostic function that allows the user to view the quality of the signal, the last time the clock received a correction signal, the performance and results of a gearbox test, and a comprehensive analysis of the entire clock movement. These diagnostic functions shall be enabled by pressing a
button on the clock movement. The clock shall require fewer than five (5) minutes to perform a correction of the hand positions. The battery-powered model of the clock shall be capable of receiving a signal every two (2) or four (4) hours. The 24V, 115VAC or 230VAC models of the clock shall be capable of receiving a signal every minute. The clock shall have a smooth surface ABS case which can be attached either directly to the wall, or to a standard-sized gang box. The round versions of the case shall be designed such that they will fit within Sapling’s wood or aluminum round clock housings. The clock case shall be produced in round cases with diameters of 9, 12, or 16 inches, or square cases with widths of 9 or 12 inches. The dial is to be made of durable polystyrene material. The crystal is to be made of shatterproof, side molded polycarbonate. The clock shall be FCC compliant, in accordance with part 15 Section 15.247.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that construction is complete in spaces to receive equipment and that rooms are clean, dry and permanent air conditioning systems are operating.

B. Verify that 120 volt electrical outlet is located within 6 feet of location of transmitter and that outlet is operational and properly grounded.

C. Provide factory services layout system transmitter and receiver equipment to ensure coverage throughout the facility.

3.02 INSTALLATION

A. Existing Master Clock:
   1. Provide reprogramming and all setup functions required to synchronize new secondary clocks with existing system.

B. Clocks: Perform the following operations with each clock:
   1. Connect to power source.
   2. Set clock to correct time in accordance with manufacturer’s instructions.
   3. Observe clock until valid signals are received and clock adjusts itself to correct time.
   4. Install the clock on the wall in the indicated location, plumb, level and tight against wall. Attach using Clock-Lock hanging method and suitable fasteners as approved by clock manufacturer.

3.03 FIELD QUALITY CONTROL

A. See Division 01 - General Requirements.

B. Inspect system to assure proper operation.
C. Manufacturer Services: Provide the services of a manufacturer authorized representative to prepare and start systems.

D. Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by clock manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

3.04 DOCUMENTATION

A. Provide copies of all manuals and two (2) sets of as-built documents, in hard copy and electronic format. As-built documentation shall include location and types of hardware provided and installed as well as the interconnection of each device.

3.05 TRAINING:

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.

B. Provide training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

C. Duration of Training: Per Section 260400.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section includes devices and connections at new access controlled doors, connected to an existing access control system.

B. Related Sections

1. Carefully examine all of the Contract Documents for requirements that affect the work of this section. Other specification sections that directly relate to the work of this section include, but are not limited to, the following:
   a. Division 08 – Door Hardware
   b. Section 27 0529 – Hangers and Supports for Communications Systems
   c. Section 27 0533 – Raceway and Boxes for Communications Systems
   d. Section 27 0553 – Identification for Communications Systems

1.02 REFERENCES

A. Reference Standards: Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section:

1. Underwriters Laboratories Inc. (UL):
   a. UL 365: Police Station Connected Burglar Alarm Units and Systems.
   b. UL 609: Local Burglar Alarm Units and Systems.
   c. UL 611: Central Station Burglar-Alarm Units.
   d. UL 636: Holdup Alarm Units and Systems.
   e. UL 684: Local, Central Station, and Remote Station.
   f. UL 1023: Household Burglar-Alarm System Units.
   g. UL 1076: Proprietary Burglar-Alarm Units and Systems.
   h. UL 1610: Central-Station Burglar-Alarm Units.

2. Federal Communications Commission (FCC):

3. Consultative Committee for International Radio (CCIR)
4. Electronic Industry Association (EIA)
5. Joint Photographic Experts Group (JPEG)
6. Moving Pictures Experts Group (MPEG)
7. Motion Joint Photographic Experts Group (MJPEG)
8. National Television Systems Committee (NTSC)
9. Phase Alternating by Line (PAL)
10. Institute for Electrical and Electronics Engineers (IEEE)
11. Physical Security Interoperability Alliance (PSIA)
12. Open Network Video Interface Forum (ONVIF)
13. Real Time Streaming Protocol (RTSP)

B. Definitions

1. HD (High-definition) – refers to video having resolution substantially higher than traditional television systems. HD has one or two million pixels per frame.
2. CIF (Common Intermediate Format) – refers to a standard video format, which is categorized based on the resolution.
3. IR (Infrared) – refers to a visual range requiring little to no light to visualize.
4. IP (Internet Protocol) – refers to a device that operates over the building’s network.
5. VMS (Video Management System) – The software that operates all video surveillance cameras.
6. NVR (Network Video Recorder) – Server that configures and stores recorded data from the cameras.
7. SMS (Security Management System) – The software that operates all access control devices.

1.03 SUBMITTALS

A. Product Data: Provide details and technical specifications for each product indicated. Include physical dimensions, features, performance, electrical characteristics, ratings, software versions, and operating system details.

B. Shop Drawings: Include system line diagrams, equipment locations, installation details, and system integration plans.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types, quantities, and sizes.
3. Wiring Diagrams: For power and signal wiring.

C. Equipment and Software List: Include every piece of equipment and software by product/model name and/or number, manufacturer, serial number, revision number, location, and date of original installation. If factory and/or bench testing regimens are required by the project plan, add pretesting record of each piece of equipment and software, listing name of person testing, date of test, and adjustments made.

D. Field Tests: Submit results of field testing of every device including date, testing personnel, retesting date if applicable, and confirmation that every device passed field testing.

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E. Provide a statement from the major manufactures showing the security contractor is an authorized representative of that product. This is to insure products are current, recall notices are acknowledged, and correct programming/installation methods are employed as recommended by the manufacturer. Include all required certifications held by installer within submittal.

1.04 CLOSEOUT SUBMITTALS
A. Division 01 – Execution and Closeout Requirements: Closeout procedures.
B. Project Record Documents: Record actual locations of all equipment.
C. Operation and Maintenance Data: Submit manufacturer’s operation and maintenance data, customized to the system installed. Include system and operator manuals.

1.05 QUALIFICATIONS
A. All work, equipment, materials, construction, and installation provided under the Contract shall comply with the current applicable rules, regulations, standards, and ordinances of the local Authorities Having Jurisdiction (AHJ).
B. Electrical Components, Devices, Accessories, and Installation shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   1. Comply with NECA 1.
   2. Comply with NFPA 70.
C. Manufacturer: Minimum five years’ experience in manufacturing and maintaining IP-based security systems. Manufacturer shall provide toll-free technical assistance and support available 24/7.
D. System integrators shall have a minimum of five years’ experience in installing IP-based security systems, and shall be certified installers of all security equipment specified herein, and on the drawings.

1.06 DELIVERY, STORAGE AND HANDLING
A. Deliver materials and product in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.07 COORDINATION
A. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.
B. Coordinate reporting of alarms to central station with Owner, Owner’s security company, police station or fire department as required by the system.

1.08 WARRANTY

A. Contractor’s Warranty: Warranty the installation to be free of defect for a period of two (2) years from date of acceptance by commissioning agent.

B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer’s warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Existing Open Options access control system to remain.

B. All new card readers, peripheral devices and related accessories shall be compatible with the existing Open Options access control system. Contractor is responsible for furnishing and installing new power supplies, reader modules, input/output modules and other accessories as recommended by manufacturer to support the access controlled doors specified on Drawings.

2.02 POWER SUPPLY

A. Furnish new power supply to support all new access controlled doors.

B. Manufacturers:
   1. LifeSafety Power #FP015/250-C8D8E4
   2. Substitutions: See Division 01 – Product Requirements.

C. Product Description: Dual-voltage (12/24 VDC) power-supply/battery charger in a lockable enclosure.
   1. 120 VAC input power rated @450W.
   2. Output Current:
      a. 12A @ 12 VDC.
      b. 10A @ 24 VDC.
   3. Battery charge Capacity: 80 Ah.
   4. C8 output module: 8 fused lock outputs, fused @ 3A each.
   5. D8 output module: 8 fused auxiliary outputs fused @ 3A each.
   7. E4 Cabinet: 24” H x 20” W x 4.5” D with key lock and backplane with standoffs for module mounting.

D. Certifications:
   1. UL294, UL 603, UL 864, UL 1076, UL 1481, UL 2044, & UL 2572.
   2. FCC Part 15, Subpart B.
E. Batteries: Provide with batteries capable of 24 hour battery back-up at full load in an appropriately sized NEMA 1 enclosure.

2.03 PERIPHERAL SECURITY DEVICES

A. Card Readers
1. Manufacturers
   a. HID multiClass SE RP40 (standard), SE RP15 (mullion).
   b. Honeywell
   c. Bosch
   d. Substitutions: See Division 01 – Product Requirements.
2. Product Description
   a. Provide contactless smart card readers as shown on the drawings.
   b. The reader shall have a Weigand output.
   c. The reader shall have both an audio and visual notification for access granted and access denied.
   d. The reader shall be suitable for both outdoor and indoor applications, and shall have an operating temperature of -31º - 150ºF.
   e. The reader shall operate up to 500ft away from door controller.
   f. The reader shall have an audible buzzer function.
   g. The reader shall support high and low frequency transmission, including but not limited to 13.56MHZ and 125KHZ frequencies.
3. Mounting
   a. Card readers shall have the ability to be mounted on glass, using kit by same manufacturer, if necessary.
   b. Security drawings are diagrammatic. Exact card reader locations shall be coordinated with door hardware installation in field.
   c. All card reader wiring shall be run in conduit, 1/2" minimum size.
   d. In locations where reader is shown on mullion, route conduit through mullion.
4. Proximity Cards
   a. Provide and program 100 proximity cards to owner to be compatible with installed access control system. Coordinate card format with Owner prior to installation.

B. Access Control Composite Cable
1. Manufacturer:
   a. West Penn
   b. Diamond Cable
   c. Essex
   d. Substitutions: See Division 01 – Product Requirements.
2. Provide composite cable consisting of wiring for card reader, request-to-exit device, door contacts and door lock power. Cabling size and type shall match wiring to these devices shown on drawings.
3. Composite cable shall be plenum rated.

C. Door Contacts
1. Manufacturers  
a. Basis of Design: General Electric  
b. Honeywell  
c. Bosch  
d. DMP  
e. Substitutions: See Division 01 – Product Requirements.

2. Product Description  
a. Closed loop magnetic door contacts with the following features:  
   1) Screw-in installation coordinated with door hardware  
   2) Maximum gap with of 1”  
   3) Single pole single throw switching  
   4) Minimum operating temperature of -40ºC or lower  
   5) Provide double pole door contact for reporting to both the access control and intrusion detection systems.

3. Provide a door contact for each access controlled door in project, unless otherwise noted.

4. Provide door contacts suitable for overhead doors, where indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine cable pathways including conduit, raceways, cable trays, and other pathway elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine rough-in for control cable and conduit systems to controllers, card readers, and other security system components to verify conduit and back-box locations prior to installation of security devices

C. Examine available network capacity and support infrastructure. Consult with network administrator for compliance with network standards and capacity.

D. Examine install location for compliance with space allocations, installation tolerance, hazards to safe system operation, and other conditions affecting installation.

E. Examine roughing-in for LAN, WAN, and IP network before device installation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Support all cabling in accordance with Section 270529 – Hangers and Supports for Communications Systems.
B. Ground all security system components and cabling in accordance with Section 260526 – Grounding and Bonding.

C. Label all security system components and cabling in accordance with Section 270553 – Identification for Communications Systems.

D. Provide all required backboxes and pathways for security system components and cabling in accordance with Section 270533 – Raceway and Boxes for Communications Systems.

E. Rated Stairs: Penetrations into stairs are NOT permitted except for items serving that stair.

F. Make all connections to built-in door wiring in junction boxes.

G. Test all components before shipping to the project location.

H. Access control system shall be installed, programmed, and tested in accordance with manufacturer’s installation instructions.
   1. Coordinate interfaces with Owner’s representative where appropriate.
   2. Provide backboxes, racks, connectors, supports, conduit, cable, and wire for a complete and reliable installation. Obtain Owner’s approval for exact location of all boxes, conduit, and wiring runs prior to installation.
   3. Install conduit, cable, and wire parallel and square with building lines, including raised floors areas. Do not exceed forty percent fill in conduits. Gather wires and tie to create an orderly installation.
   4. Coordinate with other trades to provide proper sequencing of installation.

I. Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the installation of the Security Management System.

J. Coordinate wiring pathway and conduit requirements through doors and frames with Division 8.

K. Division 8 to provide all electrified hardware including, but not limited to: electric locks, electrified panic hardware, electrified door closers, transfer hinges; and power transfer devices. Wiring of devices by Division 28.

L. Coordinate door and frame prep requirements for magnetic door contacts and request-to-exit devices supplied by Division 28 with Division 8.

M. Comply with TIA 569-C, "Commercial Building Standard for Telecommunications Pathways and Spaces."

N. Card Readers and Keypads and Peripheral Devices:
   1. Install number of conductor pairs recommended by device manufacturer for the functions specified.
2. Follow device manufacturer’s installation requirements for maximum cable distances and sizes.

3.03 FIELD COMMISSIONING AND CERTIFICATION

A. Field Commissioning: Test system as recommended by manufacturer, including the following:
   1. Conduct complete inspection and testing of equipment, including verification of operation with connected equipment.
   2. Test devices and demonstrate operational features for Owner’s representative and authorities having jurisdiction as applicable.
   3. Correct deficiencies until satisfactory results are obtained.
   4. Submit written copies of test results.

B. Tests and Inspections:
   1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA 568-C, "Commercial Building Telecommunications Cabling Standards - Part 1: General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA 568-C.
   2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power-supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
   3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. The Integrator shall demonstrate the functionality of the security system upon completion of installation, documenting the result of all tests and providing these results to the Owner.
   1. The security system shall be tested in accordance with the following:
      a. The Integrator shall be responsible for documenting and entering the initial database into the system debugging all issues. Prior to full operation, a complete demonstration of the computer real-time functions shall be performed. A printed validation log shall be provided as proof of operation for each software application package. In addition, a point utilization report shall be furnished listing each point.
      b. Upon satisfactory on-line operation of the system software, the entire installation including all subsystems shall be field inspected. Each device shall be tested as a working component of the
completed system. All system controls shall be inspected for proper operation and response.

c. Tests shall demonstrate the response time and display format of each different type of input sensor and output control device. Response time shall be measured and documented with the system functioning at full capacity. Computer operation shall be tested with the complete data file.

d. The Integrator shall maintain a complete log of all inspections and tests. Upon final completion of system tests, a copy of the log records shall be submitted as part of the as-built manuals along with a letter of certification to indicate that the tests have been performed, and all devices are operational.

e. The completed system shall be tested in front of the owner or owner’s agent. The system test shall be witnessed by the Authority Having Jurisdiction if necessary. Any deficiencies noted during the testing must be corrected.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Supply and install new fire alarm initiating devices and notification appliances connected to an existing addressable fire alarm system. Supply and install expansion modules and other devices as required in existing fire alarm control panel to accommodate new devices.

B. Related Sections:
   1. Division 07 – Firestopping
   2. Division 08 – Hardware (for magnetic door hold open devices)
   3. Division 21 – Fire Protection (for flow detection devices)
   4. Division 23 – HVAC (for smoke dampers and fire/smoke dampers)
   5. Section 26 05 19 – Building Wire and Cable
   6. Section 26 05 26 – Grounding and Bonding
   7. Section 26 05 33 – Identification for Electrical Systems, for labeling and identification requirements.

1.02 REFERENCES


B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 72 - National Fire Alarm and Signaling Code


E. NFPA 601 - Standard for Security Services in Fire Loss Prevention

1.03 SYSTEM DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented
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by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

C. Basic Performance:
1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class B circuits, unless otherwise indicated on drawings.
2. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit, unless otherwise indicated on drawings.
3. All circuits shall be power-limited, per UL864 9th edition requirements.
4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm when wire NFPA Style 6/7.
5. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

D. Alarm Sequence of Operation: Refer to fire alarm riser diagram on drawings.

E. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
1. Visual and audible trouble alarm indicates by zone at fire alarm control panel.
2. Visual and audible trouble alarm indicates at remote annunciator panel.
3. Trouble signal transmits to municipal connection.

1.04 SUBMITTALS

A. Division 01: Submittal procedures.

B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate annunciator layout, and design calculations.

C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

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G. Submit complete fire alarm battery calculations, taking all devices within building into account.

1.05 CLOSEOUT SUBMITTALS

A. Division 01: Closeout procedures.
B. Project Record Documents: Record actual locations of fire alarm equipment.
C. Operation and Maintenance Data: Submit manufacturer’s standard operating and maintenance instructions.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.
B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.
D. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years documented experience, and certified by the State as fire alarm installer.
E. Products: Listed and classified by Underwriters Laboratories, Inc as suitable for the purpose specified and indicated.

1.07 MAINTENANCE SERVICE

A. Division 01: Maintenance service.
B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.08 EXTRA MATERIALS

A. Division 01: Spare parts and maintenance products.
B. Provide (2) fire alarm audio/visual appliances, complete with all labor, material, and programming, to be located in the field as directed by the Local Authority having Jurisdiction.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations.
Protect from all possible damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.10 COORDINATION

A. Division 01: Pre-Installation conferencing.

B. Coordinate the installation of cable and equipment with other construction activities and the work of other sections.

C. Coordinate all connections to the building’s HVAC system with the Division 23 contractor.

D. Coordinate all connections to the building’s fire suppression system with the Division 21 contractor.

E. Coordinate all connections to door hardware with the Division 08 contractor.

1.11 WARRANTY

A. Contractor’s Warranty: Warranty the installation to be free of defect for a period of two (2) years.

B. Equipment Warranty: Each piece of equipment shall carry a two(2) year manufacturer’s warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Notifier addressable fire alarm system, to match existing equipment on site.

B. No substitutions permitted.

2.02 FIRE ALARM CONTROL PANEL

A. Existing Notifier AM1010 fire alarm control panel to remain.

B. Provide all interface modules, amplifiers, power supplies, expansion modules, and other devices required to integrate fire alarm devices indicated on drawings with existing fire alarm system.

2.03 INITIATING DEVICES

A. Addressable Heat Detector
   1. Product Description: Addressable combination rate-of-rise and fixed temperature, spot heat detector.
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3. Rate-of-Rise: 15 degrees F (8.3 degrees C).
4. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement.
5. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet.

B. Addressable Photoelectric Ceiling Smoke Detector
1. Product Description: NFPA 72, addressable photoelectric type ceiling smoke detector with the following features:
   a. Adjustable sensitivity.
   b. Plug-in base
2. Mounting: 4 inch (102 mm) outlet box.
3. Furnish two-wire detector with common power supply and signal circuits.
4. The smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions.
5. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.

C. Addressable Carbon Monoxide Detector
1. Detectors shall meet UL2034 and UL2075.
2. Detectors shall be ceiling mounted.
3. Detectors shall be connected to the fire alarm system and shall have supervised circuits.
4. Detectors shall be addressable and may be in combination with a smoke detector.
5. Detectors shall be connected as a separate zone or programmed as a separate zone and shall only activate a supervisory signal at the main fire alarm control panel and at the remote annunciator panel.
6. Detectors shall not activate the building evacuation system.

D. Addressable Dry Contact Monitor Module
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
3. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
E. **Addressable Control Module**
   1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.
   2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
   3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
   4. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

2.04 **SIGNALING APPLIANCES**

A. **Speakers**
   1. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
   2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
   3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
   4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
   5. All notification appliances shall be backward compatible.
   6. Speakers shall receive a separate twisted pair from the fire alarm control panel for voice communications.
   7. **Combination speaker/strobe devices shall meet the requirements specified under “Strobes” in addition to these specifications.**

B. **Strobes**
   1. The strobe shall consist of a xenon flash tube with associated lens/reflect system, and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe’s entire operating voltage range.
   2. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and be fully synchronized.
2.05 CONDUIT AND WIRE

A. Fire alarm cabling shall be wire in conduit, unless metal clad (MC) cable is specifically permitted to be installed by the Authority Having Jurisdiction, and is specified as an acceptable means of installation on the drawings.

B. Metal Clad (MC) Cable:
1. Type FPLP cable with galvanized interlocking steel with continuous red stripe.
2. NEC Article 760 rating for fire alarm control cables.
3. Install multiconductor cabling in accordance with NEC article 730.
4. Use permitted above accessible ceilings and concealed within walls to devices. Provide conduit and wire for final homeruns to control panels, transponders and power supplies.
5. Conductors shall comply with “Wire” paragraph below.

C. Conduit:
1. Conduit shall be in accordance with the National Electrical Code (NEC), local and state requirements.
2. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum.
7. All fire alarm junction boxes and raceways shall be identified and labeled in accordance with Section 26 05 33, “Identification for Electrical Systems”.

D. Wire:
1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the SLC multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication loop.
6. All field wiring shall be completely supervised.
7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs).

E. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.

F. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

G. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01: Coordination and project conditions.
B. Verify products and systems receiving devices are ready for installation.

3.02 INSTALLATION

A. Division 1 - Quality Control: Manufacturer’s instructions.
B. Install manual station with operating handle 4 feet above finished floor.
C. Install audible and visual signal devices 6 feet 8 inches above finished floor.
D. Install 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors, or as indicated on drawings.
E. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors and fire protection storage tank level sensor.
F. Automatic Detector Installation: Conform to NFPA 72E and NFPA 720 (remotely located from heating appliances as possible).

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G. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

H. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

I. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas, or on existing block constructed walls with no means to fish wiring.

J. Locate intelligent CO detectors as far away from CO source (fossil fuel burning appliance) as practical to minimize false alarms while maintaining manufacturer spacing criteria and NFPA required coverage.

K. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Field technicians shall be NICET Level 1 (minimum) certified.

L. The factory trained technician shall install initial data and artwork at each interactive firefighter’s display.

M. The factory trained technician shall design the graphic layout based on area diagrams and floor plans.

3.03 MANUFACTURER’S FIELD SERVICES

A. Division 01: Manufacturer’s field services.

B. Include services of factory certified technician to supervise installation, adjustments, final connections, and system testing.

3.04 TEST

A. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72 and the following:

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Open initiating device circuits and verify that the trouble signal actuates.
3. Open and short signaling line circuits and verify that the trouble signal actuates.
4. Open and short notification appliance circuits and verify that trouble signal actuates.
5. Ground all circuits and verify response of trouble signals.
6. Check presence and audibility of tone at all alarm notification devices.
7. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
8. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
9. When the system is equipped with optional features, the manufacturer’s manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

B. Test carbon monoxide detectors and any associated alarms in accordance with NFPA 72H, NFPA 720, manufacturer’s instructions and local fire department requirements.

3.05 FINAL INSPECTION/ ACCEPTANCE TESTING

A. Division 01 – Quality Control.

B. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

C. Fire Alarm/Acceptance Testing Procedures:
1. The fire alarm testing shall be as the authority having jurisdiction shall dictate. This will be as determined by the AHJ and shall include, but not be limited to, the requirements as set below:
   a. Protective Signaling Systems: All protective signaling systems shall meet with acceptance testing requirements of the applicable standards listed in NFPA 101 and NFPA 13.
   b. Prior Test Notification: At least five (5) working days prior to testing, the Electrical Contractor shall notify (in writing) the following people of the proposed date the acceptance tests are to be performed:
      1) Authority Having Jurisdiction
      2) General Contractor or Construction Manager
      3) Engineer of Record
      4) Equipment Supplier Representative
      5) Sprinkler Contractor (if applicable)
      6) HVAC Contractor (if applicable)
      7) Elevator Contractor (if applicable)

D. Certificates of Compliance:
1. A Fire Alarm System Inspection and Testing Certification and Description form shall be prepared for each system per the requirements listed in NFPA 72, Chapter 7.

2. After the completion of the operational acceptance tests and sign-off of test witness (with stipulations noted), final copies of the Certificates shall be forwarded to the AHJ.

E. Tests:
   1. All tests shall be conducted in accordance with the Manufacturer’s Testing Recommendations.
   2. All testing equipment, apparatus (i.e. sound level decibel meter, 2-way radio communication, test devices, ladders, tools, lighting, etc.) and personnel shall be supplied by the Electrical Contractor.

3.06 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation" to the Owner.

C. Manufacturers representative shall provide Owner with on site training of the system.

D. Duration of training: Per Section 260400.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 1 Specifications Sections apply to this Section.

B. State of Connecticut Department of Transportation Form 816 and 818, as applicable.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for walks, pavements, turf and grasses and plants.
2. Subbase course for concrete walks.
3. Subbase course and base course for asphalt paving.
4. Excavating and backfilling for utility trenches, foundations and retaining wall.
5. Retaining wall, stone base and drainage.
6. Dewatering

1.3 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

K. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

L. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

M. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

N. Controlled Soil Material: Site soil that has been determined to contain higher levels of residual pesticides as a result of past agricultural practices.

1.4 QUALITY ASSURANCE

A. Pre-excavation Conference: A pre-construction meeting shall be held as directed by the Owner.

B. Form 818 – State of Connecticut Department of Transportation “Standard Specifications for Roads, Bridges, and Incidental Construction”, 2004 with supplements shall be used for material compliance and execution of the work in this section.

C. Prior to earthwork activities, coordinate with the owner’s Testing Agent to assure and schedule all testing as may be required by the owner.

1.5 PROJECT CONDITIONS

A. Utility Locator Service: Notify ‘Call Before You Dig’ at least 72 hours prior to the construction effort.

B. Do not commence earth moving operations until all appropriate erosion control measures, construction fencing and pedestrian protection measures are in place.

C. All existing on-site soils are to remain on-site. Any exceptions to this must be approved in writing by the Owner.
PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. Frozen materials are considered Unsatisfactory

D. Subbase Material: Additional material shall meet CT DOT Form 818 M.02.02 Subbase.

E. Processed Aggregate Base Course: Shall meet CT DOT Form 818 M.05.01 Processed Aggregate Base.

F. Bedding Course: Shall meet CT DOT Form 818 M.08.03.01 Bedding Material

G. Gravel Base shall meet CT DOT Form 818M.02.03

H. Crushed Stone: consist of a ¾-inch size durable crushed rock or durable crushed gravel stone and shall conform to the requirements of the ConnDOT Form 818, Section M.01.01, No. 6

2.2 ACCESSORIES

A. Warning Tape: Shall meet CT DOT Form 818 section 1.05.15

2.3 Retaining wall: Two, Three and four feet long interlocking Bin Blocks to achieve dimensions indicated. Each concrete bin block to be 24” high by 24” wide, with minimum #6 Grade 60 rebar lifting hook constructed with 6000 PSI concrete (at 28 days).

2.4 Perforated PVC 4” diameter drain pipe wrapped with filter material, and associated pipe fittings.
PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. All existing on-site soils are to remain on-site. Any exceptions to this must be approved in writing by the Owner.

3. All Controlled Soil Material shall be handled and reused on-site in accordance with Project Plans.

4. Controlled Soil Material shall not be comingled or mixed with other site soils.

5. Shore all excavations to prevent collapse.

3.3 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.4 EXCAVATION FOR UTILITY TRENCHES

A. Contractor shall obtain and follow the requirements and specifications of the applicable utility providers. Where those requirements differ from those noted herein, the more restrictive shall govern.
B. Excavate trenches to indicated gradients, lines, depths, and elevations.

C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

D. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material, 4 inches (100 mm) deeper elsewhere, to allow for bedding course, or as required by the utility company.

3.5 SUBGRADE INSPECTION

B. Proof-roll subgrade below sidewalks and pavements with a vibratory roller or other equipment approved by the Engineer to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Sub-grades that become unstable (i.e. soft, yielding, rutting, pumping, etc.) under the action of proof-rolling may require selective undercutting or further stabilization prior to placement of the structural fill or base stone.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under all construction, pipe, or conduit as directed by the Engineer.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
   2. Stockpile topsoil on site to use within berms and lawn areas. Grade as shown.

3.8 STORAGE OF CONTROLLED SOIL MATERIALS

A. The Contractor shall construct stockpiles and sediment and erosion controls in
accordance with the terms and conditions of the CT DEEP "General Permit for Contaminated Soil and/or Sediment Management (staging and transfer)".

B. The Contractor shall prevent or minimize the transfer or infiltration of controlled soils from the stockpiles to the ground.

C. The Contractor shall manage all materials in such a way as to minimize tracking of controlled soils across the site and/or off-site and minimize dust generation.

D. Polyethylene plastic sheeting for covering stockpiled material shall be a minimum thickness of 4 mil.

E. Sandbags, or other weights that will not puncture the polyethylene cover, shall be used to anchor the cover.
   1. Weights shall be placed along all cover seams and a minimum of one row of weights shall be placed in the middle of each polyethylene sheet.

F. If polyethylene sheeting is ripped or damaged during construction of the stockpile, or observed to be damaged during inspections, it shall be repaired or replaced immediately.

3.9 UTILITY TRENCH BACKFILL

A. Contractor shall obtain and follow the requirements and specifications of the applicable utility providers. Where those requirements differ from those noted herein, the more restrictive shall govern.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Place and compact initial backfill in accordance with appropriate utility company requirements to a height of 12 inches (300 mm) over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Install warning tape in accordance with CT DOT Form 818 Section 1.05.15 requirements and utility company requirements.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in lifts to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use Granular Fill and conform to CT DOT Form 818 Section M.02.01.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in lifts not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557 (Modified AASHTO Compaction).

1. Under pavements and concrete walks, scarify and recompact top 12 inches of existing subgrade and each lift of backfill or fill soil material at 95 percent of the maximum dry density.
2. Under bituminous walkways and gravel paths, scarify and recompact top 6 inches below subgrade and compact each lift of backfill or fill soil material at 95 percent of the maximum dry density.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each lift of backfill or fill soil material at 85 percent of the maximum dry density.
4. For utility trenches, compact each lift of initial and final backfill soil material at 95 percent of the maximum dry density.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. During construction, positive grading will be maintained to direct storm runoff away from buildings and foundations.
2. Final grading shall be done to insure positive grading to direct storm runoff away from buildings and foundations.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/2 inch.
3. Pavements: Plus or minus 1/2 inch.

3.14 GRADING OF INFILTRATION BASINS AND SYSTEMS

A. Infiltration basins and systems shall not be excavated to final grade until the contributing drainage area has been constructed and fully stabilized unless additional erosion prevention and sediment controls are provided.

B. When an infiltration system is excavated to final grade (or within 3 feet of final grade), the Contractor must employ rigorous erosion prevention and sediment controls to keep sediment and runoff completely away from the infiltration area.

C. The infiltration area must be staked off and marked so that heavy construction vehicles or equipment will not compact the soil in the proposed infiltration area. Infiltration systems shall not be put online until final stabilization of the site.

3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.

2. Place subbase course and base course that exceeds 6 inches in compacted thickness in lifts of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage qualified personnel to perform tests and inspections. Contractor shall provide a minimum of 72 hours’ notice of proposed earthwork activities.

B. Allow qualified personnel to inspect and test subgrades and each fill or backfill lift. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. When qualified personnel reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. Do not allow debris to collect near doors or building openings during construction. Maintain the site in a clean and neat appearance throughout the construction process.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory waste materials, including unsatisfactory trash and debris, with the exception of site soils, and legally dispose of them off Owner's property. All existing on-site soils are to remain on-site. Any exceptions to this must be approved in writing by the Owner.

3.19 DEWATERING

A. Work shall include all material, labor, and equipment required for the removal of water from the excavated areas to maintain in a dry condition all excavations and work areas. The Contractor shall be responsible for performing all required dewatering in such a manner as to prevent injury to persons, public health, the environment, or damage to existing facilities.

B. The Contractor shall be responsible for providing, maintaining, operating, and removing all dewatering equipment and other facilities, including all pumping and appurtenant equipment, required to maintain the area in a dry condition during construction.

C. Any damage to existing including settlement caused by dewatering operations, or damage to new work due to failure of the Contractor to maintain a dry work area shall be repaired by the Contractor as directed by the Engineer at no additional cost.

D. The Contractor’s dewatering process shall be performed in such a manner as to limit the quantities of sediment removed.


F. All pipelines or structures not stable against uplift shall be thoroughly braced or otherwise protected against movement or damage.

G. Water being disposed of by the dewatering operation shall be discharged into properly sized sedimentation control basins, or other appropriate structures. In no case shall the water from the dewatering process be allowed to flow directly into a wetland or watercourse.

H. The dewatering process shall be initiated in any excavated area where excess water accumulates preventing the work to be performed in dry conditions.

3.20 RETAINING WALL
A. Prepare base for wall with compacted ¾” crushed stone as indicated.

B. Set bin blocks true to lines in a running bond, interlocking blocks, and fitting them tightly to each other. Step blocks down at ends to follow line of existing grade.

C. Install perforated pipe around outside face of wall and slope to daylight at each end. Fill ends of pipe with ¾” stone.

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 1 Specifications Sections apply to this Section.

B. State of Connecticut Department of Transportation Form 816 and 818, as applicable.

H. ADA Standards for Accessible Design – 2010 (9/05/11, DOJ)


1.2 SUMMARY

A. Section Includes:
   1. Concrete walks
   2. Concrete pads
   3. Concrete Joint Sealant

B. Related Sections:
   1. Section 312000 "Earth Moving" for aggregate subbase and base courses.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each exposed product and for each color and texture specified.

C. Other Action Submittals:
   1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. American Concrete Institute (ACI) Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.
PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.


C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Deformed-Steel Wire: ASTM A 496/A 496M.

F. Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI’s "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: Shall meet CT DOT Form 818 M.03.01.
   a. Fly Ash: Shall meet CT DOT Form 818 M.03.01 3(c) B.

   Normal-Weight Aggregates: Shall meet CT DOT Form 818 M.03.01 1&2.

C. Water: Potable and complying with CT DOT Form 818 M.03.01 4.

D. Air-Entraining Admixture: Shall meet CT DOT Form 818 M.03.01 5.

E. Chemical Admixtures: Shall meet CT DOT Form 818 M.03.01 5.

2.3 CURING MATERIALS

A. Curing Materials: Shall meet CT DOT Form 818 M.03.01 4.

2.4 RELATED MATERIALS

A. Joint Fillers: Shall meet CT DOT Form 818 M.03.02 2.

B. Base material: Shall meet CT DOT Form 818 M.02.
PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Proof-roll prepared subbase surface below concrete walks, pads, etc. Identify soft pockets and areas of excess yielding.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

C. All concrete areas along an Accessible Route as designated on the Drawings shall conform to ADA, ADAAG, and PROWAG guidelines, as applicable. The Contractor shall notify the Engineer in writing if these guidelines cannot be met. Construction shall not commence in the areas of concern until the Contractor has received a response from the Engineer.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.5 JOINTS

A. General:
1. Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
2. Joints shall be spaced and located as specified in ACI 301 unless otherwise indicated on the Drawings.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

C. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness.

D. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT
A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.

B. Comply with CT DOT Form 818 6.01 requirements for measuring, mixing, transporting, placing, and consolidating concrete.

C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place. D. Screed paving surface with a straightedge and strike off.

E. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer’s written instructions after placing, screening, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete in accordance with CT DOT Form 818 6.01.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 1/2 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/2 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.

B. Protect concrete sidewalks, curbs and pads from damage.

C. Maintain concrete free of stains, discoloration, dirt, and other foreign material. Sweep concrete not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION
***
SECTION 32 13 73
CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and asphalt pavement.

B. Related Sections
   1. Section 32 13 13 Concrete Paving and Curbing
   2. Section 32 13 16 Cast-In-Place Concrete

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type and color of joint sealant required.

C. Product certificates and test reports.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

   1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Colors of Exposed Joint Sealants: As selected by Architect.

2.2 COLD-APPLIED JOINT SEALANTS

A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutralcuring, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.

C. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

D. Install backer materials to support sealants during application and at position required to produce optimum sealant movement capability. Do not leave gaps between ends of backer materials. Do not stretch, twist, puncture, or tear backer materials. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

E. Install sealants at the same time backings are installed to completely fill recesses provided for each joint configuration and to produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION
***
SECTION 32 31 14
COLOR CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all equipment, materials, and appurtenances to do all work necessary to construct the color chain link fence and gates, as indicated on the drawings and as specified. Work includes but is not limited to the following:
   1. Color fence framing system
   2. Color chain link fence fabric

1.2 RELATED WORK

A. Examine contract documents for requirements that affect work of this section.

1.3 QUALITY ASSURANCE

A. Chain link fencing manufactured in accordance with the requirements of the CLFMI Manual. Manufacturer of the fencing system must be a CLFMI member.

B. Form 817 - State of Connecticut Department of Transportation "Specifications for Roads, Bridges, Facilities and Incidental Construction" 2016 edition with supplements shall be used for material compliance and execution of the work in this section.

1.4 SUBMITTALS

A. Product Data: Submit catalog cuts and manufacturer’s detail specifications for all materials and equipment to be incorporated into the work.

B. Warranty: Color chain link fence systems supplied with minimum fifteen (15) year factory warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Framework for color chain link fence systems shall conform to Ameristar® PermaCoat® PC40™ Fence Pipe (industrial weight), as manufactured by Ameristar Fence Products in Tulsa, Oklahoma or approved equal. Qualified manufacturers shall have a minimum of five years experience manufacturing PVC coated chain link fencing.

B. Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.
C. Approved Manufacturer: Ameristar Fence Products; Phone: (800) 321-8724

D. Fax: (877) 926-3747

2.2 MATERIAL – STEEL FRAMEWORK

A. The steel material used to manufacture fence pipe shall be zinc-coated steel strip, galvanized by the hot-dip process conforming to the criteria of ASTM A653 and the general requirements of ASTM A924.

B. The zinc used in the galvanizing process shall conform to ASTM B6. Weight of zinc shall be determined using the test method described in ASTM A90 and shall conform to the weight range allowance for ASTM A653, Designation G-210.

C. The framework shall be manufactured in accordance with commercial standards to meet the strength (50,000 psi minimum yield strength) and coating requirements of the following standards: 1.) ASTM F1043, Group IC, Electrical Resistance Welded Round Steel Pipe, heavy industrial weight. 2.) M181, Type I, Grade 2, Electrical Resistance Welded Steel Pipe. 3.) RRF-191/3, Class 1, Grade B, Electrical Resistance Welded Steel Pipe.

D. The exterior surface of the electrical resistance weld shall be recoated with the same type of material and thickness as the basic zinc coating.

E. The manufactured framework shall be subjected to a complete thermal stratification coating process (multi-stage, high-temperature, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish.

F. The material used for the base coat shall be a zinc-rich (gray color) thermosetting epoxy; the minimum thickness of the base coat shall be (2) mils. The material used for the finish coat shall be a thermosetting “no-mar” TGIC polyester powder; the minimum thickness of the finish coat shall be (2) mils. The stratification coated pipe shall demonstrate the ability to endure a salt spray resistance test in accordance with ASTM B117 without loss of adhesion for a minimum exposure time of 3,500 hours. Additionally, the coated pipe shall demonstrate the ability to withstand exposure in a weather-ometer apparatus for 1,000 hours without failure in accordance with ASTM D1499 and to show satisfactory adhesion when subjected to the cross-hatch test, Method B, in ASTM D3359. The polyester finish coat shall not crack, blister or split under normal use.

G. The color of all framework is as indicated on the plan sheets and shall be in accordance with ASTM F934.

H. The strength of fence pipe shall conform to the requirements of ASTM F1043; the minimum weight shall not be less than 90% of the nominal weight. The strength of line, end, corner and pull posts shall be determined by the use of 4’ or 6’ cantilevered beam test. An alternative method of determining pipe strength is by the calculation of bending moment. Conformance with this specification can be demonstrated by measuring the yield strength of a randomly selected piece of pipe from each lot and calculating the section modulus. The yield strength shall be determined according to the methods described in ASTM E8. For materials under this specification, the 0.2 offset method shall be used in determining yield strength. Terminal posts, line posts and top/bottom rails shall be precut to specified lengths.
2.3 MATERIAL – FENCE FABRIC

A. The material for chain link fence fabric shall be manufactured from galvanized steel wire. The weight of zinc shall meet the requirements of ASTM F668, Table 4. Galvanized wire shall be PVC-coated to meet the requirements of ASTM F668. The class of the fence fabric shall be Class 2B – Fused and Bonded.

B. Selvage: Top edge knuckled and bottom edge knuckled.

C. Color: The coating color for the fence fabric shall be black. Reference ASTM F688 and ASTM F934.

D. Wire Size: The size of the steel wire core shall be as indicated on the plan sheets. The finished size of the coated wire is as indicated on the plan sheets.

E. Height and Mesh Size: The fabric height shall be as indicated on the plan sheets with a mesh size as is indicated on the plan sheets.

2.4 MATERIAL – FENCE FITTINGS

A. The material for fence fittings shall be manufactured to meet the requirements of ASTM F626. The coating for all fittings shall be the same PermaCoat color coating system required for the framework; the color for all fittings shall be as indicated on the Contract Drawings in accordance with ASTM F934.

2.5 MATERIAL – GATES

A. Swing gates shall be manufactured and coated to meet the requirements of ASTM F900. The color of all gates shall be "black" or as indicated on the Contract Drawings.

2.6 VINYL (PVC) PRIVACY SLATS

A. General: Provide privacy slats where shown on the Contract Drawings.

B. Slats: PVC "Locktop" Slats with non-winged.
   1. Height: As Specified in Drawings.
   2. Color: Black

2.7 CONCRETE

A. Concrete post footings as indicated on the Contract Drawings and in conformance with Section 32 13 16 "Cast-In-Place Concrete".

PART 3 - EXECUTION

3.1 EXAMINATION
A. Verify areas to receive fencing are completed to final grades and elevations.
B. Ensure property lines and legal boundaries of work are clearly established.

3.2 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F567.
B. Space line posts uniformly.
C. Concrete set terminal and gate posts: Drill holes in firm, undisturbed or compacted soil. Holes should have a diameter 4 times greater than outside of post, and depths approximately 6" (150 mm) deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36" (900 mm) below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.
D. Gate hardware: Set keepers, stops, sleeves, and other accessories into concrete.
E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
F. Bracing: Install horizontal pipe brace at mid-height for fences 6’ (1830 mm) and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Install braces and adjust truss rod, ensuring posts remain plumb.
G. Tension wire: Provide tension wire at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties or clips. Secure tension wire to fabric with 12-1/2 gauge [.0985" (2.502 mm)] hog rings 24" on center (609.6 mm).
H. Top rail: Install lengths, 21’ (6400 mm). Connect joints with sleeves for rigid connections for expansion/contraction.
I. Rails: Center rails are to be installed when fence fabric is 10’ or higher or when shown on drawings. Bottom rails are to be installed when shown on drawings.

3.3 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side, and attach so that fabric remains in tension after pulling force is released. Leave approximately 2” (50 mm) between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15” (380 mm) on center and to rails, braces, and tension wire at 24” (600 mm) on center.
B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands spaced maximum of 15” (380 mm) on center.

3.4 GATE INSTALLATION

A. Install gates plumb, level, and secure for full opening without interference.
B. Attach hardware by means which will prevent unauthorized removal.

C. Adjust hardware for smooth operation.

3.5 ACCESSORIES

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.6 CLEANING

A. Clean up debris and unused material and remove from the site.

END OF SECTION
***
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes repairs to areas of existing lawns disturbed by new construction and specifically includes:
   1. Topsoil
   2. Seeding

1.2 DEFINITIONS

A. Substantial Completion: The establishment time until a date when a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches and 3” height.

B. Maintenance Period: The date when substantial completion is met for a period of time outlined in this specification.

C. Finish Grade: Elevation of finished graded topsoil.

D. Topsoil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath topsoil.

F. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

1.3 QUALITY ASSURANCE

A. The Owner reserves the right to require testing and reject for cause any material not meeting material specifications by tests in accordance with methods adopted by the Associate of Official Agricultural Chemists. Costs for these tests shall be borne by the Contractor.

B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when seeding is in progress.

C. Topsoil Analysis: Report suitability of topsoil for lawn growth. State the recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

D. Products and acceptability of the stand of grass shall be established by the Landscape Architect or an approved representative in writing, following the completion of all maintenance work.
requirements as specified herein, and following the correction of all punch list deficiencies by the Contractor

E. Analysis and standards - Package standard products with manufacturer certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemists, wherever applicable.

1.7 TOLERANCES FOR GRADES

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are indicted, or between such points and existing grades.

B. Shall be free from irregular surface changes, loose, friable, per Article 3.0 Execution and as withing 2” of top of paving and sidewalks.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in new, sealed, containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging. Seed in damaged packaging is not acceptable.

B. Deliver fertilizer in sealed waterproof bags showing weight, chemical analysis and name of manufacturer.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work to ensure that the work performed is scheduled to minimize damage to lawn areas.

1.10 MAINTENANCE SERVICE

A. Irrigation: Provide temporary irrigation when no permanent irrigation is part of the project until final acceptance.

1. Contractor is responsible for the irrigation, labor, materials, oversight all-inclusive until the final acceptance of the lawn.

B. Maintenance through establishment is required.

C. Maintenance duration owned by the contractor is as follows:

1. When substantial completion is met March through August, the maintenance period shall be 30 days.

2. When substantial completion is met in or after September, the maintenance period shall extend into the next growing season. The maintenance period of 30 days begins in that next growing season when the grass reaches a 3” height.

D. When maintenance extends into the next growing season, the contractor shall test the soil and amend soil. Contractor shall overseed in the spring of that next season.
PART 2 - PRODUCTS

2.1 TOPSOIL

A. Particle size - Particle size analysis of the topsoil will be determined by ASTM F 1632, Particle Size Analysis conducted by a laboratory accredited by the American Association of Laboratory Accreditation. Test must be recent and approved prior to delivery of material to the site and meet the following:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10</td>
<td>85-100</td>
</tr>
<tr>
<td>No. 40</td>
<td>35-85</td>
</tr>
<tr>
<td>No. 200</td>
<td>10-35</td>
</tr>
<tr>
<td>&lt;20µm</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

No stones over 3/4 inch in diameter

B. Organic matter content - 7% at time of seeding and 5% min at substantial completion of the grass.

C. Nutrients – as recommended by the 3rd party agricultural extension.

D. Soluble salt content measuring EC with a conductivity meter in a soil-water extract using a soil to solution ratio of 1:4.3.4.

E. Shall be free of clods, vegetative matter such as sod and wood, contaminants that affect plant growth, foreign material (concrete, glass, etc.) and environmental contaminants that include volatile organic compounds, total petroleum hydrocarbons, metal elements and pesticides that will impact reconstruction of the athletic fields and their surrounds.

F. Shall have a soil pH range of 6.4-7.0

G. Available phosphorus of greater than 5 lbs. per acre as determined by the modified Morgan extractant. If the soil pH and soil available phosphorus is below 6.4 and 5 lbs. per acre respectively, then agricultural limestone and fertilizer phosphorus are to be added to the topsoil to achieve the minimum above before reuse or delivery to the site.

H. The original source of the topsoil borrow shall be from an A or Ap horizon of a naturally occurring soil and not compounded by intentional mixing of component soils.

2.2 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA’s "Journal of Seed Technology: Rules for Testing Seeds" for purity and germination tolerances.

B. Each species shall be a top 10 performer on the National Turf Evaluation Program (NTEP.org)

C. Species mix: State-certified seed of grass species, as follows:

1. Bluegrass 40% by weight.
2. Perennial Rye Grass 30% by weight.
3. Fine and Red Fescue 30% by weight.
2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Retain one of two subparagraphs below. Class T is more finely ground and quicker acting but dustier than Class O.
2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 decisiemens/m.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:


C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 142 lbs. per acre of 20-10-10.

2.6 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

2.7 PESTICIDES
A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.8 IRRIGATION

A. When permanent irrigation isn’t part of the project, provide temporary irrigation until final acceptance of the lawn.

B. Permanent irrigation shall be per the irrigation plans and specifications

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. Loosen subsoil with a reverse tine tiller or equivalent mechanical tiller inch minimum depth followed with a clutipacker.

B. Prepare subgrade to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes in level areas.

C. Screen topsoil to remove stones ¾ inch and larger.

D. Remove foreign materials, debris, weeds, undesirable plants, roots, branches, stones in excess of 1/2 inch in size. Remove subsoil contaminated with petroleum products, or other materials, which would inhibit healthy plant growth.

E. In areas where equipment is used for hauling and spreading topsoil and has compacted subsoil, the soil is to be loosened and approved by the owner or their representative.

F. Amend topsoil by mixing on-site in stockpile areas prior to placing topsoil and verify prior to placement topsoil meets requirements.

3.2 PLACING AND TREATING TOPSOIL

A. Equipment must be tracked or low-pressure turf equipment for spreading topsoil or work conducted after placement of topsoil.

B. Topsoil is to be placed without compaction, unless otherwise directed. Fine grading operations smooth and compact the topsoil adequately.

C. 6” depth tilling of the topsoil required to uncompact topsoil due to compaction will be at no additional cost to the project.

D. Amend topsoil and mix topsoil on-site while construction is taking place.

E. Provide report and sample of amended topsoil

F. Place both stockpiled topsoil and or borrow during dry weather; place to a minimum uncompacted depth of 6 inches on dry unfrozen subgrade.
G. Fine grade topsoil, making changes in grade gradual, eliminating rough or low areas. Blend slopes into level areas. Manually spread topsoil close to trees, plants, and building to prevent damage. Fill depressions to ensure positive drainage.

H. Remove roots, weeds, rocks and foreign material while spreading.

I. If the soil must be amended after stock pile mixing, apply additional fertilizer in accordance with manufacturer’s instructions, or testing agency recommendations, within 10 days of seeding with low compaction equipment.

J. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

K. Lightly water to aid the dissipation of fertilizer.

L. After incorporation of fertilizer and limestone into the soil, fine grade seed bed to remove all ridges and depressions, and the surface cleared of all stones 3/4 inch or more in diameter and all other debris.

3.3 IRRIGATION

A. Temporary irrigation shall be approved and operational within 24hrs of seeding.

3.4 SEEDING

A. Apply seed as recommended by the seed supplier at each seeding. The contractor shall seed the lawn twice, in two separate applications.

1. The first application will use a slit seeder

   a. Hydroseeding over the slit seeding is acceptable on the first application

2. The overseeding will be a slit seeder and perpendicular to the first application at a timing to be determined during the establishment period

B. Do not seed areas in excess of that which can be mulched on same day.

C. Do not sow immediately following rain or snow, when ground is too dry, or during windy periods.

D. Ensure the seed has 1/8” to ¼” inch depth of soil with seed.

E. Immediately following seeding apply approved straw mulch to a thickness of 1/8 inch, keeping clear of and trees.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.5 LAWN MAINTENANCE

A. The Contractor is responsible for all mowing during establishment and Maintenance Period.
B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Grade, and replant bare or eroded areas and mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.

C. Mow lawn as soon as top growth is tall enough to cut (3 inches). Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grassleaf growth in initial or subsequent mowings.

3.6 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn areas: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.7 INSPECTION AND ACCEPTANCE

A. When landscape work is completed, including maintenance, Landscape Architect will, upon request, make an inspection to determine acceptability.

B. Final acceptance of seeded lawns is based on an established turf thickly uniform and well developed over 95% of the bed and ready for the Owner to use and occupy. The Contractor is responsible for all mowing until final acceptance.

END OF SECTION

***
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 01 21 00 Allowances. All Shrubs shall be purchased, delivered to the site, and unloaded under an allowance.

1.2 SUMMARY

A. Section Includes:
   1. Shrubs
   2. Organic Mulching

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

G. Topsoil: The upper portion of a soil, typically the first layer from existing grade, usually dark colored and rich in organic matter and soil organisms.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

C. Planting Schedule: Indicating anticipated planting dates for exterior plants.
D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year.

1.5 QUALITY ASSURANCE

Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis:
   1. Furnish soil analysis by a qualified soil-testing laboratory. Provide a minimum of four (4) test samples taken from different areas on the site. Submit all test results to the Engineer for review and approval.
   2. Report suitability of topsoil for plant growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

D. Form 817 - State of Connecticut Department of Transportation "Specifications for Roads, Bridges, Facilities and Incidental Construction" 2016 edition shall be used for materials compliance and execution of the work in this section, inclusive of specification modifications contained in this specification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not prune shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.

B. Handle planting stock by root ball.

C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1.7 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
      b. Structural failures including plantings falling or blowing over.
   2. Warranty Periods from Date of Substantial Completion:
      a. Trees and Shrubs: One year.
      b. Ground Cover and Plants: One year.
1.8 MAINTENANCE SERVICE

Initial Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period for Trees and Shrubs: 12 months from date of planting completion.
2. Maintenance Period for Ground Covers and Plants: 12 months from date of planting completion.

PART 2 - PRODUCTS

2.1 SHRUB MATERIAL

A. General: Furnish nursery-grown shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Root-Ball Depth: Furnish shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

C. Provide balled and burlapped or container-grown shrubs.

2.4 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.
   b. All topsoil from off site is to be screened material. Re-use of on-site topsoil requires screening of topsoil stockpiled on site.

2.5 INORGANIC SOIL AMENDMENTS

Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
2.6 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 7 decisiemens/m.

B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.7 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

2.8 MULCHES

A. Organic Mulch: Ground or shredded bark.

2.9 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
   4. Weight of Lime per 1000 Sq. Ft.: per PH test to achieve 6.0 – 6.5.
PART 3 - EXECUTION

3.1 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Thoroughly blend planting soil mix off-site before spreading; or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
   2. Spread planting soil mix to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.2 SHRUBS

A. Excavation of Pits and Trenches for Shrubs: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

C. Stock with Root Balls: Set trees and shrubs plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
   1. Balled and Burlapped: Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
   2. Container Grown: Carefully remove root ball from container without damaging root ball or plant.
   3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

D. Organic Mulching: Apply 4-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.

3.3 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

3.5 PLANTING BED MULCHING

A. Mulch backfilled surfaces of planting beds and other areas indicated.
1. Organic Mulch: Apply 4-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.6 PLANT MAINTENANCE

A. Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION

***