WCB CENTRAL BUILDING
BASEMENT TENANT IMPROVEMENT

Architectural, Structural, Mechanical
and Electrical Specifications

ISSUED FOR TENDER
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Division No.</th>
<th>Section Name</th>
<th>Number of Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 01 – General Requirements – Not Used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Division 02 – Existing Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02 41 19 Selective Structure Demolition</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Division 03 – Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 20 00 Concrete Reinforcing</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>03 30 00 Cast-in-Place Concrete</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Division 04 – Masonry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 22 00 Concrete Unit Masonry</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Division 05 – Metals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05 12 23 Structural Steel for Buildings</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>05 52 00 Metal Railings</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Division 06 – Wood and Plastics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06 10 13 Wood Blocking and Curbing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Division 07 – Thermal and Moisture Protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 21 16 Blanket Insulation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>07 84 00 Firestopping</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>07 92 00 Joint Sealing</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Division 08 – Openings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08 11 13 Metal Doors and Frames</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>08 14 16 Flush Wood Doors</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>08 71 10 Door Hardware – Common Requirements</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>08 91 19 Fixed Louvers</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Division 09 – Finishes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09 21 16 Gypsum Board Assemblies</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>09 22 16 Non-Structural Metal Framing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>09 51 13 Acoustical Panel Ceilings</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>09 65 10 Resilient Flooring</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>09 68 13 Tile Carpeting</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>09 69 00 Access Flooring</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>09 91 00 Painting</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Division 10 – Specialties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 11 00 Visual Display Surfaces</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10 22 26 Operable Partition</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10 26 13 Wall and Door Protection</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10 44 13 Fire Extinguishers</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Section No.</td>
<td>Section Name</td>
<td>Number of Pages</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Division 11 – Equipment – Not Used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Division 12 – Furnishings</strong></td>
<td>For Information Only – Not Issued for Tender 12 50 00 - Furniture</td>
<td></td>
</tr>
<tr>
<td><strong>Division 13 – Special Construction – Not Used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Division 14 – Conveying Systems – Not Used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Division 20 - Mechanical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 05 01</td>
<td>General Mechanical Provisions</td>
<td>9</td>
</tr>
<tr>
<td>20 05 05</td>
<td>General Documentation</td>
<td>6</td>
</tr>
<tr>
<td>20 05 06</td>
<td>Systems Demonstration and Owner's Instructions</td>
<td>3</td>
</tr>
<tr>
<td>20 05 07</td>
<td>Materials Testing</td>
<td>3</td>
</tr>
<tr>
<td>20 05 08</td>
<td>Equipment Testing and Start-Up</td>
<td>4</td>
</tr>
<tr>
<td>20 05 23</td>
<td>Valves and Strainers</td>
<td>4</td>
</tr>
<tr>
<td>20 05 29</td>
<td>Supports, Anchors, Seals, Pipe and Duct Penetration</td>
<td>7</td>
</tr>
<tr>
<td>20 05 53</td>
<td>Mechanical Identification</td>
<td>6</td>
</tr>
<tr>
<td>20 20 10</td>
<td>Pipe and Pipe Fittings</td>
<td>6</td>
</tr>
<tr>
<td>20 20 30</td>
<td>Piping and Equipment Insulation</td>
<td>6</td>
</tr>
<tr>
<td>20 22 00</td>
<td>Testing, Balancing and Adjusting</td>
<td>7</td>
</tr>
<tr>
<td>20 30 33</td>
<td>Electric and Electronic Control Systems</td>
<td>5</td>
</tr>
<tr>
<td><strong>Division 21 – Fire Suppression</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 05 01</td>
<td>General Provisions Fire Suppression</td>
<td>1</td>
</tr>
<tr>
<td>21 05 05</td>
<td>Documentation for Fire Suppression</td>
<td>2</td>
</tr>
<tr>
<td>21 05 06</td>
<td>Demonstration and Owner's Instruction for Fire Suppression</td>
<td>1</td>
</tr>
<tr>
<td>21 05 07</td>
<td>Materials Testing - Fire Suppression</td>
<td>2</td>
</tr>
<tr>
<td>21 05 08</td>
<td>Fire Suppression Equipment Testing and Start-Up</td>
<td>3</td>
</tr>
<tr>
<td>21 05 09</td>
<td>Pipe and Pipe Fittings for Fire Suppression Systems</td>
<td>4</td>
</tr>
<tr>
<td>21 05 29</td>
<td>Hangers and Supports for Fire Suppression Piping and Equipment</td>
<td>3</td>
</tr>
<tr>
<td>21 05 53</td>
<td>Painting and Identification for Fire Suppression</td>
<td>1</td>
</tr>
<tr>
<td>21 13 13</td>
<td>Wet Pipe Fire Suppression Sprinkler Systems</td>
<td>4</td>
</tr>
<tr>
<td>21 50 01</td>
<td>Fire Extinguishers</td>
<td>2</td>
</tr>
<tr>
<td><strong>Division 22 – Plumbing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 05 01</td>
<td>General Provisions Plumbing</td>
<td>1</td>
</tr>
<tr>
<td>22 05 05</td>
<td>Documentation for Plumbing</td>
<td>1</td>
</tr>
<tr>
<td>22 05 07</td>
<td>Materials Testing Plumbing Systems</td>
<td>1</td>
</tr>
<tr>
<td>22 05 08</td>
<td>Plumbing Equipment Testing and Start-Up</td>
<td>1</td>
</tr>
<tr>
<td>22 05 29</td>
<td>Hangers, Supports and Access Doors for Plumbing</td>
<td>1</td>
</tr>
<tr>
<td>22 05 53</td>
<td>Painting and Identification for Plumbing</td>
<td>1</td>
</tr>
<tr>
<td>22 13 16</td>
<td>Sanitary Waste and Vent Piping</td>
<td>1</td>
</tr>
<tr>
<td>22 13 19</td>
<td>Sanitary Waste Piping Specialties</td>
<td>2</td>
</tr>
<tr>
<td>Section No.</td>
<td>Section Name</td>
<td>Number of Pages</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Division 23 – HVAC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 05 01</td>
<td>General Provisions HVAC</td>
<td>1</td>
</tr>
<tr>
<td>23 05 05</td>
<td>Documentation for HVAC Equipment</td>
<td>1</td>
</tr>
<tr>
<td>23 05 07</td>
<td>Materials Testing - HVAC System</td>
<td>1</td>
</tr>
<tr>
<td>23 05 08</td>
<td>HVAC Equipment Testing and Start-Up</td>
<td>1</td>
</tr>
<tr>
<td>23 05 29</td>
<td>Hangers and Support, Anchors, Seals and Access Doors For HVAC Piping and Equipment</td>
<td>1</td>
</tr>
<tr>
<td>23 05 48</td>
<td>Vibration Isolation</td>
<td>4</td>
</tr>
<tr>
<td>23 05 53</td>
<td>Painting and Identification for HVAC Systems</td>
<td>1</td>
</tr>
<tr>
<td>23 05 92</td>
<td>Coordination with Balancing Agency</td>
<td>2</td>
</tr>
<tr>
<td>23 05 93</td>
<td>Testing, Adjusting and Balancing for HVAC Systems</td>
<td>1</td>
</tr>
<tr>
<td>23 07 13</td>
<td>Ductwork Insulation</td>
<td>7</td>
</tr>
<tr>
<td>23 09 01</td>
<td>General Provisions for HVAC Controls</td>
<td>1</td>
</tr>
<tr>
<td>23 23 17</td>
<td>Direct Expansion Refrigeration Piping Systems</td>
<td>4</td>
</tr>
<tr>
<td>23 31 13</td>
<td>Metal Ducts</td>
<td>6</td>
</tr>
<tr>
<td>23 31 14</td>
<td>Ductwork Cleaning</td>
<td>4</td>
</tr>
<tr>
<td>23 33 13</td>
<td>Air Duct Accessories</td>
<td>3</td>
</tr>
<tr>
<td>23 36 16</td>
<td>Single Duct Air Terminal Units</td>
<td>2</td>
</tr>
<tr>
<td>23 37 13</td>
<td>Air Outlets and Inlets</td>
<td>2</td>
</tr>
<tr>
<td>23 81 26</td>
<td>Split System Air Conditioners</td>
<td>6</td>
</tr>
<tr>
<td><strong>Division 26 - Electrical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 05 00</td>
<td>Electrical General Requirements</td>
<td>11</td>
</tr>
<tr>
<td>26 05 01</td>
<td>Existing Electrical Facilities</td>
<td>4</td>
</tr>
<tr>
<td>26 05 07</td>
<td>Testing, Adjusting and Balancing of Electrical Equipment and Systems</td>
<td>2</td>
</tr>
<tr>
<td>26 05 08</td>
<td>Electrical Equipment and Systems Demonstration and Instruction</td>
<td>1</td>
</tr>
<tr>
<td>26 05 28</td>
<td>Grounding</td>
<td>1</td>
</tr>
<tr>
<td>26 05 29</td>
<td>Fastenings and Supports</td>
<td>3</td>
</tr>
<tr>
<td>26 05 31</td>
<td>Splitters, Junction Boxes, Pull Boxes and Cabinets</td>
<td>2</td>
</tr>
<tr>
<td>26 05 32</td>
<td>Outlet Boxes, Conduit Boxes and Fittings</td>
<td>2</td>
</tr>
<tr>
<td>26 05 33</td>
<td>Raceways</td>
<td>2</td>
</tr>
<tr>
<td>26 05 34</td>
<td>Conduits, Conduit Fastenings and Conduit Fittings</td>
<td>4</td>
</tr>
<tr>
<td>26 09 25</td>
<td>Digital Network Lighting Controls</td>
<td>7</td>
</tr>
<tr>
<td>26 10 03</td>
<td>Wires and Cables 0 - 1000 V</td>
<td>3</td>
</tr>
<tr>
<td>26 24 26</td>
<td>Connections to Mechanical Equipment</td>
<td>2</td>
</tr>
<tr>
<td>26 29 01</td>
<td>Contractors</td>
<td>1</td>
</tr>
<tr>
<td>26 50 00</td>
<td>General Provisions for Interior Lighting</td>
<td>3</td>
</tr>
<tr>
<td>26 50 04</td>
<td>Lamps and Ballasts</td>
<td>6</td>
</tr>
<tr>
<td><strong>Division 28 – Electronic Safety and Security</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 31 00</td>
<td>Fire Detection and Alarm</td>
<td>7</td>
</tr>
</tbody>
</table>
WCB CENTRAL BUILDING
BASEMENT TENANT IMPROVEMENT

Architectural and Structural Specifications

ISSUED FOR TENDER

<table>
<thead>
<tr>
<th>Rev. #</th>
<th>Date</th>
<th>Description</th>
<th>Originator</th>
<th>Checked</th>
<th>Approved</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oct 04, 2017</td>
<td>Issued for 90% Review</td>
<td>MM</td>
<td>GM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Oct 31, 2017</td>
<td>Issued for 100% Review</td>
<td>MM</td>
<td>GM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Nov 14, 2017</td>
<td>Issued for Tender</td>
<td>MM</td>
<td>GM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Part 1  General

1.1  SECTION INCLUDES

.1 Alteration project procedures.
.2 Asbestos and hazardous materials
.3 Removal of designated building equipment and fixtures.
.4 Removal of designated construction.
.5 Disposal of materials
.6 Identification of utilities.
.7 Refer to items as indicated.

1.2  ALTERATION PROJECT PROCEDURES

.1 Materials: As specified in product sections; match existing products and work for patching and extending work.
.2 Employ skilled and experienced installer to perform alteration work.
.3 Remove, cut, and patch work in a manner to minimize damage and to provide means of restoring products and finishes to specified condition.
.4 Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
.5 Where new work abuts or aligns with existing, provide a smooth and even transition. Patch work to match existing adjacent work in texture and appearance.
.6 When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Consultant for review.
.7 Where a change in the surface of 1/4 inch or more occurs, request instructions from Consultant or submit recommendation for providing a smooth transition; to Consultant for review.
.8 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.
.9 Finish surfaces as specified in individual product sections.

1.3  ASBESTOS AND HAZARDOUS MATERIALS

.1 Be aware that asbestos containing materials and hazardous materials have been identified within this building.
.2 As per the Hazardous Building Materials Management Plan, provided by the Owners, asbestos containing materials have been identified by type and location.
.3 The Owners are responsible for any asbestos abatement requirements.
None of the demolition required within the Architectural scope of work as noted in the design documentation, contains asbestos containing materials as per the Hazardous Material Assessment, provided by the Owners.

Stop work and notify the Owners immediately if any further hazardous materials are identified during demolition.

Discussions will be required during the pre-construction start up meeting to outline these requirements.

**ADMINISTRATIVE REQUIREMENTS**

**Sequencing:** Sequence work to requirements

1.

Sequence activities to demolish the Work in the following order:

.1 Protection:
   .1 Prevent movement, settlement or disruption of adjacent work.
   .2 Provide and install bracing where required.
   .3 Erect and maintain dust proof partition. Seal off Mechanical ducts as required.
   .4 Building is currently inhabited and in use, proceed with demolition only after ascertaining building function will be unduly impaired.

.2 Material:
   Carefully remove all items indicated on the drawings to be retained by the Owners and obtain instructions from the Owners regarding disposal methods of any items.

.3 Existing Services: Coordinate with the building operator, the disconnection and removal of all electrical communication and data lines in the area that are to be demolished. The owner’s IT personnel to remove data and communication lines as required.

.4 Demolition: Remove from site all material to be demolished. Carry out demolition in an orderly and careful manner and minimize inconvenience to adjacent occupied spaces.

**Perform noisy work:**

.1 During days and times allowed by the Owner.

**SUBMITTALS FOR REVIEW**

.1 Shop Drawings: Indicate removal sequence and location of salvageable items, demolition; location and construction of temporary work.

**CLOSEOUT SUBMITTALS**

.1 Record Documentation: Accurately record actual locations of capped utilities, subsurface obstructions, and any notable findings.
1.7 REGULATORY REQUIREMENTS
   .1 Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and/or reconnection.
   .2 Obtain required permits from authorities.
   .3 Do not close or obstruct egress width to any building or site exit.
   .4 Do not disable or disrupt building fire or life safety systems without three (3) days prior written notice to Owner.
   .5 Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.8 PROJECT CONDITIONS
   .1 Conduct demolition to minimize interference with adjacent and occupied building areas.
   .2 Cease operations immediately if structure appears to be in danger and notify Consultant. Do not resume operations until directed.

Part 2 Products

2.1 MATERIALS
   .1 Not Used.

Part 3 Execution

3.1 PREPARATION
   .1 Provide, erect, and maintain temporary barriers at locations indicated.
   .2 Erect and maintain weatherproof closures for exterior openings.
   .3 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.
   .4 Protect existing materials and surfaces which are not to be demolished.
   .5 Prevent movement of structure; provide bracing and shoring.
   .6 Notify affected utility companies before starting work and comply with their requirements.
   .7 Mark location and termination of utilities.
   .8 Provide appropriate temporary signage including signage for exit or building egress.

3.2 DEMOLITION
   .1 Disconnect remove, cap and identify designated utilities within demolition areas.
   .2 Demolish in an orderly and careful manner. Protect existing supporting structural members.
.3 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

.4 Remove materials as work progresses. Upon completion of work, leave areas in clean condition.

.5 Remove any temporary work, such as temporary bracing or blocking.

3.3 SCHEDULES

.1 Remove the following equipment and materials for the Owner's retention. Deliver to location designated by Owner:

   .1 Confirm with Owner if any additional items not noted below are required to be removed.

.2 Owner will remove and keep the following material and equipment:

   .1 Existing file cabinets and shelving.
   .2 Remove existing furniture, systems furniture and wall panels, and equipment within the existing file vault.
   .3 Computers, printers, and work-related electronics.
   .4 Furniture such as desks, chairs, small file cabinets, and accessories.

.3 Protect the following materials and equipment remaining:

   .1 Acoustic Ceiling tile and grid in the CSC file clerks room.
   .2 Electrical light fixtures and mechanical diffusers in the CSC file clerks room.
   .3 Fire Alarm and life safety equipment where indicated to remain
   .4 Confirm with Owner if additional items are required to remain and be protected.

END OF SECTION
1.0 GENERAL

1.1 Section Includes

.1 This Section specifies requirements for demolishing, salvaging and removing wholly or in part, various items designated to be removed or partially removed from the building area, cutting and removal in preparation for new work and remedial work including, but not limited to;

.1 Removal of walls, floors and/or ceilings.
.2 Door and/or window removal scheduled for infilling or reinstallation.
.3 Creation of new openings in existing construction complete with new supporting construction.
.4 Removal, capping, abandoning and/or re-routing of existing mechanical and electrical services.
.5 Removal of millwork, finishes and/or equipment designated to be removed.

1.2 Related Sections

.1 Temporary Facilities and Controls Section 01 50 00
.2 Execution and Closeout Requirements Section 01 70 00

1.3 Reference Standards

.1 All demolition work is to be in accordance with the Alberta Building Code (2006), Local Bylaws, Occupational Health and Safety Regulations, Workmen’s Compensation Act and Issued Permit Regulations.
.3 Obtain any required permits required for completion of demolition work.

1.4 Submittals

.1 Provide detailed sequence of demolition and removal work to ensure coordination with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed new addition, if applicable.
.2 Provide photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner's Representative prior to start of Work.
1.5 Project Conditions

.1 Owner and Engineer assumes no responsibility for actual condition of items or structures to be demolished. All dimensions of existing areas are only approximate. Any representations in these documents are not in any way warranted or guaranteed by the Owner or Consultant(s).

.2 It is the Contractor’s responsibility to check, verify and confirm all heights, dimensions and conditions required to carry out this demolition work. Any errors and/or discrepancies between the working drawings and site conditions are to be reported to the Engineer immediately.

.3 Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner’s removal and salvage operations prior to start of selective demolition Work.

.4 Protect existing items designated to remain and materials designated for salvage. In the event of damage to such items, immediately replace or make repairs to approval of Owner and at no cost to Owner.

.5 If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution. Notify Owner and stop work.

.6 Any deviation from the detailed working drawings must be approved by the Engineer prior to construction. Modifications and adjustments shall be made accordingly for any conflict or discrepancies based on assumed conditions only upon instructions from the Engineer.

1.6 Coordination And Safety

.1 Conduct selective demolition Work in manner that will minimize need for disruption of Owner’s normal operations. Provide minimum of seventy-two (72) hours advance notice to Owner of demolition activities that will affect Owner’s normal operations. Approval required by Owner to proceed.

.2 Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

.3 Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities

.4 Maintain fire protection services during selective demolition operations.

.5 Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
.6 Do not use cutting torches for removal until Work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

.7 Maintain security of the building for the entire demolition period. Provide temporary closures for created openings and removed construction areas.

.8 Ensure public safety for entire demolition period.

1.7 Disposal

.1 Remove from building Site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose of off Site.

.2 Burning of removed materials is not permitted on the Project Site.

.3 Landfill and/or dry waste disposal costs are to be included in the Tender amount.

2.0 PRODUCTS

2.1 Materials Ownership

.1 Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner’s property, demolished materials shall be become the Contractor’s property and shall be removed from the Site. Template should be used indicating all materials leaving site daily.

.2 Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during demolition, remain the Owner’s property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

3.0 EXECUTION

3.1 Preparation

.1 Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

.2 Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

.3 Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of seventy-two (72) hours advance notice to Owner if shutdown of service is necessary during changeover.
3.2 Demolition

.1 Perform selective demolition Work in a systematic manner. Use such methods as required to complete Work indicated on Drawings in accordance with demolition schedule and governing regulations.

.1 Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power driven masonry saw or hand tools; do not use power driven impact tools.

.2 Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

.3 Demolish foundation walls to a depth of not less than 12" (300 mm) below existing ground surface, unless noted. Demolish and remove below grade wood or metal construction. Break-up below grade concrete slabs.

.4 For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

.5 Completely fill below grade areas and voids resulting from demolition Work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6" (150 mm) in diameter, roots, or other organic matter.

.2 Concrete parts of structures below the permanent ground-line shall be neatly squared off with reinforcement cut off close to the concrete.

.3 Dismantle steel structures or steel portions of structures in sections as required.

.1 The sections shall be of such weight and dimensions which permit convenient handling, hauling and storing.

.2 Flame-cutting will not be permitted when Drawings call for the structural unit to be salvaged in such a manner as to permit re-erection. In such cases, all members shall be carefully dismantled without damage, match marked with paint, and all rivets and bolts removed from the connections.

.4 Remove brick and stone structures by sledging the masonry into removal sizes. Portions of such structures below the permanent ground-line, which will not in any manner interfere with the proposed construction, may be left in place.

.5 If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Engineer in written, accurate detail for redesign and/or direction.

.6 Separate materials for salvage and/or recycling as required or appropriate for disposal requirements.
3.3 Clean-Up And Repair

.1 Upon completion of demolition Work, remove tools, equipment, and demolished materials from the Project Site. Remove protections and leave interior areas broom clean.

.2 Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition Work.

END OF SECTION
1.0 GENERAL

1.1 Related Requirements

.1 Cast-in-Place Concrete Section 03 30 00
.2 Concrete Unit Masonry Section 04 22 00
.3 Structural Steel for Buildings Section 05 12 23

1.2 References

.1 All referenced standards shall be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.

.2 Canadian Standards Association (CSA International):

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A23.3, Design of Concrete Structures.

.3 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Reinforcing Steel Institute of Canada (RSIC):

.1 Reinforcing Steel Manual of Standard Practice.

.4 American Concrete Institute (ACI):

.1 SP-66, ACI Detailing Manual.

.5 ASTM International Inc.:


.2 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel.


.4 ASTM A1044 / A1044M, Standard Specification for Steel Stud Assemblies for Shear Reinforcement of Concrete.
1.3 Quality Assurance

.1 In accordance with Section 01 43 00 – Quality Assurance.

.2 Qualifications

.1 Welding of reinforcing steel to be performed by welders certified under CSA W186.

.2 Shear stud reinforcing to be fabricated in an ICC ES approved facility.

.3 Samples

.1 Samples for Architectural Concrete

.1 Submit one (1) sample for bar supports and side form spacers to be used for exposed concrete.

1.4 Quality Control

.1 Submit in accordance with Section 01 45 00 - Quality Control.

.2 Source Quality Control Submittals:

.1 Upon request, provide WSP-S with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request, inform WSP-S of proposed source of reinforcement material to be supplied.

.3 Upon request, provide WSP-S with a copy of plant certificate by the Concrete Reinforcing Steel Institute for epoxy coating of reinforcement.

.4 Upon request, provide WSP-S with a copy of manufacturer’s instructions for patching factory applied epoxy coating.

1.5 Allowance

.1 Allowance to include all costs including supply, detailing, fabricating and placement of rebar.

.2 Provide detailed records of use.

.3 Provide credit for unused portion of the allowance.

1.6 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer’s data sheets for mechanical rebar splices.
.3 Shop Drawings:

.1 Prepare shop drawings in accordance with RSIC Manual of Standard Practice unless the Contract Documents contain a more stringent requirement. Conform to ACI SP-66 Detailing Manual whenever a detail condition is not covered by any of the above.

.2 Submit plans, elevations, sections and details necessary to fabricate, place and review reinforcement without reference to structural drawings, including masonry wall reinforcement. Draw to scale not smaller than 1:50 (¼” = 1’-0”).

.3 Show on drawings:

.1 Sizes, spacings and locations of reinforcement, with identifying labels.
.2 Bar bending details.
.3 Lengths and locations of all lap splices.
.4 Types and locations of mechanical splices.
.5 Placing sequence.
.6 Large scale details at areas of steel concentration (such as column / beam / wall intersections), and around cast-ins.
.7 Bar lists.
.8 Quantities of reinforcement (including all rebar added to accommodate installation).
.9 Construction joint, control joint and pour gap locations.
.10 Strip dimensions for flat slab and flat plate.
.11 Concrete cover.

.4 Do not release for fabrication reinforcing bars whose length may be affected by field conditions, such as the final elevation of footings, until obtaining the required field measurements.

2.0 PRODUCTS

2.1 Materials

.1 Reinforcing steel: carbon steel, deformed bars to CSA G30.18., unless indicated otherwise.

.2 Weldable Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.

.3 Stainless Reinforcing steel: deformed bars to ASTM A955/A955M.

.4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
.5 Welded steel wire fabric: to ASTM A1064/A1064M. Provide in flat sheets only.

.6 Epoxy Coating of reinforcement: to ASTM A775/A775M.

.7 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.

.8 Mechanical splices: to concentrically align bars and develop specified tensile strength of rebar. Threaded couplers to have plastic internal coupler thread protectors.

.9 Rebar terminators: oversized taper-threaded couplings capable to develop specified tensile strength of rebar; area to be not less than 5 times the rebar area.

.10 Plain round bars: to CSA G40.20/G40.21.

.11 Shear stud reinforcing: per ASTM A1044. Min yield strength for studs – 350 MPa, for rails – 300 MPa.

.12 Expansion cap for dowels at expansion / contraction joints: plastic, tight fitting, with internal pin to locate dowel and create void for expansion.

3.0 EXECUTION
3.1 Fabrication

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice.

.2 Fabricate epoxy coated reinforcing steel in accordance with ASTM D3963/D3963M. Plants to be certified by the CRSI for epoxy coated steel. Provide colour to contrast sharply with reinforcing steel and rust colour.

.3 Stagger mechanical splices 750 mm (2'-6") unless otherwise noted on drawings.

.4 Weld reinforcement in accordance with CSA W186 where indicated.

.5 Fabricate shear stud reinforcing according to CSA W59. Weld studs to rail to develop.

.6 Ship bundles of bar reinforcement, clearly identified in accordance with bar lists.

.7 Provide standard hooks at ends of all hooked bars.

.8 Substitute different size bars only if permitted in writing by WSP-S.
3.2 Field Bending

.1 Do not field bend or field weld reinforcement except where indicated or authorized by WSP-S.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure. Use tools which will limit bend radii to the values given in CSA A23.1.

.3 Where key-creating stay form with pre-installed blind dowels is used, bend the dowels out using special tools approved by the stay form manufacturer.

.4 Replace bars which develop cracks or splits.

3.3 Placing Reinforcement

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1/A23.2.

.2 Remove all loose scale, dirt, oil or other coatings which would reduce bond.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Turn ends of tie wire towards the interior of concrete.

.5 Support bars, chairs and spacers:

.1 Provide sufficient support bars, chairs, carriers and side form spacers as necessary to secure against displacement of reinforcement and maintain concrete cover before and during concrete placement. Support devices contacting surfaces exposed to the exterior to be non-corroding. Bars which are not shown on Structural Drawings and whose only function is supporting other reinforcing in lieu of other supporting devices to be considered accessories.

.2 Use bar supports for beams and slabs.

.3 Use side form spacers for walls and columns.

.4 Use plastic or plastic tipped bar supports and spacer with colour to match concrete for exposed concrete surfaces.

.5 Use plastic bar supports, epoxy coated support bars and plastic coated tie wire for epoxy coated reinforcement.

.6 Use precast concrete chairs where supports rest on the ground. Where welded wire fabric is used in slabs-on-grade, place precast concrete chairs at 600 mm (2'-0") on centre each way. Do not attempt to position welded wire fabric by lifting it after concrete is poured.
.6 Do not splice reinforcing at locations other than shown on placing or structural drawings without WSP-S written approval.

.7 Do not cut reinforcement without WSP-S written approval.

.8 Unless otherwise noted on drawings, stagger alternate mechanical couplers 750 mm (2'-6") apart.

.9 Install end bearing compression splices so that bearing ends are fitted to within 3 degrees of full bearing after splice installed.

.10 Do not field weld reinforcement except where indicated or authorized by WSP-S.

.11 Slip dowels:

.1 Use plain round bars.

.2 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.

.3 When paint is dry, apply thick even film of mineral lubricating grease.

.4 Provide plastic expansion cap at embedded end to create void and allow movement.

.12 Obtain WSP-S field review of all reinforcing materials and placement before pouring concrete.

3.4 Inspection and Testing

.1 An independent Inspection and Testing Agency will be appointed to carry out inspection and testing of concrete reinforcing and check conformance with applicable Standards and Contract documents.

.2 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required.

.3 The Agency will submit reports covering the work inspected and provide details of errors or deficiencies observed.

.4 When requested, the Agency will review mill test reports and correlate reinforcing steel supplied with mill test reports provided.

.5 If reinforcing steel cannot be correlated to mill test reports, the Agency will conduct a sufficient number of tests to determine the yield strength of the reinforcing steel supplied.

.6 The Agency will inspect installation of all post installed dowels for compliance with the procedure described on the Contract Documents and the adhesive supplier’s requirements.
.7 The Agency will inspect field welding of reinforcement, including welders' qualification, welding procedure, fit-up and alignment, weld profile, size and length and confirm that the reinforcing is of weldable grade.

.8 The Agency will inspect installation of all mechanical splices for alignment and compliance with the splice supplier's requirements.

.9 The Agency will inspect placement of reinforcing steel, including rebar position, grade, size, number and spacing, concrete cover and lap / development lengths provided. The inspection will be based on Structural drawings, rather than placement drawings.

END OF SECTION
1.0  GENERAL

1.1  Related Requirements

.1  Concrete Reinforcing  Section 03 20 00
.2  Concrete Unit Masonry  Section 04 22 00

1.2  References

.1  All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.

.2  Canadian Standards Association (CSA International):

   .1  CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
   .2  CSA A283, Qualification Code for Concrete Testing Laboratories.
   .3  CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.3  ASTM International Inc.:


.4  Canadian General Standards Board (CGSB):

   .1  CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3  Quality Assurance

.1  In accordance with Section 01 43 00 – Quality Assurance.
.2  Qualifications

   .1  Concrete supplier to have a valid "Certificate of Ready Mixed Concrete Production Facilities" issued by the relevant Ready Mixed Concrete Association.
1.4 Quality Control

.1 Submit in accordance with Section 01 45 00 - Quality Control.

.2 Minimum two (2) weeks prior to starting concrete work, provide valid certificate from plant delivering concrete.

   .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.3 For concrete with high volume of supplementary cementing materials (HVSCM concrete, as defined in CSA A23.1), perform trial mixes to ensure that the required properties are achieved.

.4 Minimum four weeks prior to starting concrete work, provide proposed quality control procedures on following items:

   .1 Hot weather concrete.
   .2 Cold weather concrete.
   .3 Curing; for HVSCM concrete, a detailed curing plan is required.
   .4 Finishing.
   .5 Protection.

1.5 Administrative Requirements

.1 Pre-installation Meeting: Convene pre-installation meeting one week prior to beginning concrete works. Ensure key personnel to attend.

.2 Batch Logs: Keep record of each batch delivered to site.

.3 Concrete Delivery Slips: Keep all concrete delivery slips ("driver’s tickets") on-site until building is completed. Record on delivery slip where concrete was placed, including time and date.

1.6 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Minimum two (2) weeks prior to starting concrete work, submit all concrete mix designs, and indicate where each concrete mix is to be used.

.3 Minimum two (2) weeks prior to placing concrete, submit marked up drawings showing concrete mix to be used for each and every concrete element.

.4 Minimum two (2) weeks prior to placing concrete, submit drawings showing proposed locations of all construction and control joints (including wall control joints and slab on grade sawcut joints) for WSP-S review and approval.
.5 Minimum submission requirements for each concrete mix design shall include the following:

.1 Minimum specified compressive strength at twenty-eight (28) days (or at the time specified on drawings).
.2 Maximum aggregate size.
.3 Aggregate type (if not normal density).
.4 Concrete density range, wet and dry (if not normal density).
.5 CSA exposure class.
.6 Cement type (if not type GU).
.7 Percentage and type of supplemental cementing materials.
.8 Maximum water/cementitious materials ratio.
.9 Assumed method of placement of concrete.
.10 Corrosion inhibitor (name and quantity, if applicable).
.11 Plastic or steel fibres (type, name and quantity, if applicable).
.12 Alkali-aggregate resistance.
.13 Architectural requirements (colour of cement and aggregate, if applicable).
.14 Maximum time from batching to placing concrete (if retarding admixtures are used).

.6 For HVSCM concrete, submit trial mixes data.

.7 Concrete pours: provide accurate records of all concrete pours marked on a set of Structural Drawings.

.8 On completion of the works, provide written report to WSP-S certifying that the concrete in place meets performance requirements established in PART 2 - PRODUCTS.

2.0 PRODUCTS

2.1 Design Criteria

.1 To CSA A23.1/A23.2, Alternative 1 – Performance, and as described under Mixes and on Structural Drawings.

2.2 Performance Criteria

.1 Concrete supplier to meet the concrete performance criteria established by WSP-S and to provide verification of compliance.
2.3 Materials

2. Cementitious hydraulic slag: to CSA A3000.
3. Fly ash: to CSA A3001, Type CI.
5. Aggregates: to CSA A23.1/A23.2. Do not use recycled concrete as aggregate.
6. Admixtures: not to contain chlorides.
8. Plastic fibre additive: fibrillated polypropylene fibres at least 19 mm (3/4") in length.
10. Non premixed dry pack grout: composition of non-metallic aggregate and Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 40 MPa at twenty-eight (28) days.
11. Curing/sealing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1, Class B, water based acrylic, compatible with surface hardener where hardener is used.
12. Pre-moulded joint fillers: min. 12 (1/2") bituminous impregnated fiber board to ASTM D1751.
13. Joint Sealants: to AST C920, class 100/50.
16. Penetrating sealer: water based, clear water repellent, at least equivalent to AT&U Type 1b as specified in Alberta Infrastructure and Transportation Publication B388.
2.4 Concrete Mixes

.1 Use ready-mix concrete. Proportion concrete in accordance with CSA A23.1, Alternative 1 - Performance Method for Specifying Concrete.

.2 Set performance characteristics of concrete in plastic state in coordination with all trades involved.

.3 Meet performance criteria of concrete in hardened state as shown on Structural Drawings and provide verification of compliance.

.4 Use water-reducing agent in all concrete.

.5 Do not use admixtures containing chlorides.

.6 Supplementary cementing materials (SCM):
   
   .1 Conform to CSA A23.1.
   
   .2 Follow slag and fly ash manufacturers' directions for proportioning and mixing of concrete.
   
   .3 Do not use SCM in architecturally exposed concrete.
   
   .4 Do not use concrete with more than 40% of SCM when ambient temperature is forecast to be below +10ºC at the time of concrete pour and during the seven (7) days after the pour, except for footings, walls and columns.
   
   .5 Reduce W/C ratio to 0.45 where using more than 40% of SCM in concrete for slabs and other horizontal finished surfaces, in order to reduce bleed water and to increase rate or strength gain.
   
   .6 For HVSCM concrete, reduce W/C ratio and comply with additional curing and protection requirements specified in CSA A23.1, including Annex K.

3.0 EXECUTION

3.1 Preparation

.1 Provide advanced notice as indicated on drawings to allow WSP-S field review of reinforcing prior to placing of concrete/closing of wall forms.

.2 Obtain WSP-S written approval before placing concrete.

.3 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
3.2 Installation/Application

.1 Set sleeves, conduits, pipe hangers, weep hole tubes, drains and other inserts and openings as indicated or specified elsewhere.

.2 Refer to Typical Details and Drawing Notes for placing guidelines, maximum size and minimum spacing of sleeves, embedded pipes and conduits.

.3 Check locations and sizes of sleeves and openings shown on Structural Drawings with Architectural, Mechanical and Electrical Drawings. Notify WSP-S of any discrepancies.

.4 Provide composite sleeving drawings showing sleeves required by all trades. Obtain WSP-S approval for any required sleeves and openings which are not shown on Structural Drawings.

.5 Set special inserts for strength testing as required for non-destructive method of testing concrete.

.6 Set anchor rods using templates under supervision of appropriate trade prior to placing concrete. Locate each anchor rod group to within 6 mm (1/4") of required location.

3.3 Placing Concrete

.1 Place concrete in accordance with CSA A23.1.

.2 Delivery and place concrete with minimum re-handling.

.3 If concrete is pumped or placed pneumatically, control discharge velocity to prevent separation or scattering of concrete mix ingredients.

.4 Place concrete in a continuous operation without cold joints. If cold joints develop inadvertently, notify WSP-S to obtain instructions for required remedial work.

.5 Where higher strength concrete needs to be puddled in slabs above columns and walls, place adjacent lower strength slab concrete within thirty (30) minutes of pouring the puddled concrete.

.6 Do not overload forms.

.7 Use rubber tipped vibrators for concrete containing epoxy coated reinforcement.

.8 Concrete exposed to view:

.1 Exposed surfaces to be dense, even, uniform in colour, texture and distribution of exposed aggregate.

.2 Defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints or excessive bug holes may be cause for rejection at the discretion of the Architect.

.9 Maintain accurate records of all poured concrete including extent, date and location of each pour, concrete mix used, ambient air temperature, test samples taken and falsework removal date and mark on a set of Structural Drawings.
3.4 Concrete Curing and Protection

.1 At a minimum cure and protect concrete in accordance with CSA A23.1

.2 Extend curing and protection period until concrete has reached following strength levels for structural safety:
  
  .1 Framed slabs and beams: 75% of specified twenty-eight (28) day strength.
  
  .2 Columns, walls, piers and footings: 50% of specified twenty-eight (28) day strength

.3 For concrete containing supplementary cementing materials, curing and protection times may need to be extended beyond those outlined by CSA A23.1 to achieve the required structural properties.

.4 Cure slab surfaces immediately after finishing is completed. Unless otherwise noted or required, use wet curing.

.5 Do not use curing compound on parking garage slabs and where bonded topping is to be applied. Cover slab surfaces with absorptive mat or fabric and keep continuously wet.

.6 Slabs on grade and structural slabs receiving resilient floor or other moisture sensitive finishes:
  
  .1 Apply twenty-four (24) hours of continuous sprinkling with water. Start immediately after finishing slab.
  
  .2 Cover slab for at least the following seventy-two (72) hours using plastic sheets with joints taped and free edges covered.
  
  .3 Protect finished and cured slab from surface water (i.e. rain, snow).
  
  .4 Refer to Architectural Specifications for required testing methods prior to placing floor finishes.

.7 Concrete exposed to view:

  .1 Protect during construction period from wear, damage, marking, discolouration, staining and becoming coated with concrete leakage.

  .2 Unless rejected, repair damage and remove marks and stains to the approval of the Architect.

.8 Do not load concrete until sufficient strength is developed.
3.5 **Existing Structure**

.1 Take precautions to protect the existing structure from damage.

.2 Remove portions of existing concrete structure as required.

.3 Provide temporary shoring and bracing as required.

.4 Retain a Professional Engineer to design the temporary shoring and bracing and to review this work on site.

.5 Obtain approval from WSP-S before coring or cutting existing slabs, beams or walls.

.6 Retain an independent testing company to locate existing reinforcement and conduit in the areas of proposed openings and to mark locations on the surfaces of slabs and walls on which the cores and cuts are to be started using a non-destructive method.

.7 Remove toppings prior to locating reinforcement and conduit.

.8 Mark locations and sizes of cores and openings and locations of reinforcement and conduit using indelible markers as follows:

.1 Red for top bars

.2 Green for bottom bars

.3 Black for cores, openings and conduit.

.9 Relocate proposed openings and repeat process at no extra cost to the Contract if proposed locations are not acceptable to WSP-S.

.10 Save the complete length of all cores. Label each core with location taken. Make all cores available for review by WSP-S. Dispose of cores only with approval of WSP-S. See details on structural drawings for sawcutting procedure.

.11 If new reinforcement is required at an opening, install reinforcement before cutting opening or shore up structure until new reinforcement is installed.

.12 Roughening existing surfaces:

.1 Where drawings call for a roughened surface, bush hammer entire surface to a full amplitude of at least 5 mm.

.13 Patching:

.1 Patch existing concrete where necessary to provide required smooth, flat surfaces for reinforcement and for other trades.
3.6 Inspection and Testing:

.1 An independent Inspection and Testing Agency (certified under CSA A283 with category to suit testing provided) will be appointed to carry out inspection and testing of concrete and concrete materials and check conformance with applicable Standards and Contract documents.

.2 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required. Provide concrete samples.

.3 The Agency will submit reports covering the work inspected and the testing performed. The reports will include the Supplier’s mix design numbers, locations in structure to which the tests relate and comments on abnormal results and conditions. The reports will be provided not later than five (5) working days after the testing is completed.

.4 Sampling, storing, curing and testing of concrete will be in accordance with CSA A23.1/A23.2.

.5 The Agency will review all submittals pertaining to concrete mix designs and certification of plant, equipment and materials.

.6 Compressive Strength Testing:

.1 One test is required for each 100 cubic meters of placed concrete, but not less than one (1) test for each concrete mix placed each day. At least three (3) tests are required for each class of concrete used.

.2 A group of three cylinders for each test will be provided. Location of concrete placement will be recorded for each cylinder set. One specimen will be tested at 7 and one at 28 days. The third specimen will be tested at 56 days if the required strength at 28 days is not achieved.

.3 If the final concrete strength is specified at 56, 90 or 120 days, a group of four cylinders will be provided. One specimen will be tested at 7 and one at 28 days, with the third specimen tested at the time the final concrete strength is specified. If the required strength is not achieved at the time specified, the fourth specimen will be tested 28 days later.

.4 One additional cylinder will be provided for each concrete mix during cold weather concreting. The specimens will be cured on-site adjacent to and under the same conditions as the work they represent, and will be tested prior to form removal.

.5 If standard on site cured cylinders are used to determine concrete strength prior to removal of formwork, they will be kept adjacent to and under the same conditions as the work they represent.
.6 If pull out tests are used to determine concrete strength prior to removal of formwork, the Inspection and Testing Agency will supply, locate and test pull out inserts. The inserts not to be located on surfaces exposed to view.

.7 If maturity tests are used to determine concrete strength prior to removal of formwork, the Inspection and Testing Agency will develop strength-maturity relationship curves, provide and install temperature sensors into fresh concrete and interpret readings in accordance with ASTM 1074.

.7 Air Entrainment Testing:

.1 One standard test for air content in plastic concrete will be conducted for each 100 cubic meters of each air entrained concrete mix.

.2 One standard test per ASTM C457 will be conducted to determine air void spacing factor in hardened concrete for each 100 cubic meters each air entrained concrete mix.

.8 Permeability Testing:

.1 One chloride ion permeability test will be conducted for each 100 cubic meters of all class C-1, A-1 and C-XL concrete mixes used for floor and roof slabs and for salt water pools.

.9 Mass Concrete Testing:

.1 All concrete slabs (including raft foundation slabs) over 600 mm (2'-0") thick, and all walls over 1000 mm (3'-4") thick are considered mass concrete.

.2 The Agency will record concrete temperature at placing.

.3 The Agency will record concrete temperature and temperature gradient during the 7 day curing period by providing, installing and monitor sufficient number of thermocouples.

.10 Fresh Density Testing:

.1 One standard fresh density test will be performed on site for each 50 cubic meters of semi-low density, low density and high density concrete. Assist the Agency to correlate fresh density with air-dry density prior to the work beginning on-site. Reports will include both fresh density and air-dry density.

.11 Bond Strength Testing:

.1 One standard bond test will be provided for each 200 square meters of bonded concrete topping placed over hardened concrete and designed to act compositely with it.
.12 Grout Testing

.1 One standard test per ASTM C1107 will be made each day when concrete grout is installed under base plates.

.2 A group of 6 cubes for each test will be provided. Three (3) cubes will be tested after 7 days, and 3 after 28 days.

END OF SECTION
1.0 GENERAL

1.1 Related Sections

.1 Concrete Reinforcing  
Section 03 20 00

.2 Cast-in-Place Concrete  
Section 03 30 00

.3 Structural Steel Framing  
Section 05 12 23

1.2 Reference Standards

.1 CAN/CSA A165 Series-04 (R2009) - CSA Standards for Concrete Masonry Units.

.2 CAN/CSA A179-04 (R2009) - Mortar and Grout for Unit Masonry.

.3 CSA A370-04 (R2009) - Connectors for Masonry.

.4 CSA A371-04 (R2009) - Masonry Construction for Buildings.

.5 CSA S304.1-04 (R2010) - Design of Masonry Structures.

.6 CAN/CSA-G30.18-09 – Carbon Steel Bars for Concrete Reinforcement.

.7 CAN/CSA A179-04 (R2009) - Mortar and Grout for Unit Masonry.

.8 CAN/CSA-A3000-08 - Cementitious materials compendium.

1.3 Quality Assurance

.1 All materials used in the Work of this Section shall be manufactured by firms licensed to supply materials for the work of this Section.

.2 All workers shall be skilled in the trade of Concrete Unit Masonry Construction and all work shall be carried out under the supervision of a qualified experienced foreman or supervisor.

1.4 Delivery, Storage And Handling

.1 Cementitious materials shall be delivered in original unbroken and undamaged packages with manufacturer’s name and brand distinctly marked, and upon delivery store in weather tight location until used on Work.

.2 Deliver aggregates where grading and other required characteristics can be maintained and contamination avoided.

.3 Deliver masonry units on pallets, suitably protected from road grime and moisture absorption due to exposure to rain or melting snow.

.4 Protect masonry materials from damage during all phases of delivery, storage and handling.
1.5 Site Conditions

.1 Examine work of other trades for defects or discrepancies and report same in writing to Consultant. Installation of any part of Work shall constitute acceptance of conditions as being satisfactory.

.2 Environment Requirements: Conform to the requirements of CSA A371 and as follows:

<table>
<thead>
<tr>
<th>Air Temp.</th>
<th>Heating of Materials</th>
<th>Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 5°C (40°F)</td>
<td>Normal masonry procedures.</td>
<td>Cover walls and materials.</td>
</tr>
<tr>
<td>Below 5°C (40°F)</td>
<td>Heat mixing water. Maintain mortar temperature between 5°C (40°F) &amp; 30°C (85°F) until placed.</td>
<td>Cover walls and materials to prevent wetting and freezing.</td>
</tr>
<tr>
<td>Below 0°C (32°F)</td>
<td>In addition to above, heat sand to minimum of 5°C (40°F). Thaw frozen sand and frozen wet masonry units before use.</td>
<td>With wind velocities over 35kph (20mph), provide windbreaks during workday and cover walls and materials at the end of each work day to prevent wetting and freezing. Maintain masonry above 0°C (32°F) by using auxiliary heat or insulated blankets for 16 hours after laying masonry units.</td>
</tr>
<tr>
<td>Below -6°C (20°F)</td>
<td>In addition to above, heat dry masonry to minimum of 5°C (40°F).</td>
<td>Provide enclosure and supply sufficient heat to maintain masonry enclosure above 0°C (32°F) for 24 hours after laying masonry units.</td>
</tr>
</tbody>
</table>

1.6 Cold Weather Requirements

.1 Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen setting beds.

.2 Remove and replace unit masonry damaged by frost or freezing conditions.

.3 Do not use salts, admixtures or antifreezes.

.4 Use approved smokeless heaters. Do not use scorched sand.
1.7 **Hot Weather Requirements**

.1 Protect unit masonry work when temperatures are above 40°C (100°F) and humidity conditions produce excessive evaporation of water from mortar and grout.

.2 Provide artificial shade and wind breaks and use cooled materials as required.

.3 Do not apply mortar to substrate with temperatures of 40°C (100°F) and above.

1.8 **Protection**

.1 Protection of Masonry: During erection, protect laid masonry from damage by weather. Cover partially completed masonry when construction is not in progress.

.1 At the end of each day’s work or at the beginning of a shutdown period, cover tops of walls, projections and sills with canvas or strong waterproof membrane, securely clamped down and overhanging each side of the wall at least 600 mm (2’-0”).

.2 Stain Prevention: Prevent grout, mortar and soil from staining the face of masonry. Immediately remove grout, mortar and soil that comes in contact with such masonry.

.1 Protect base of walls from rain-splashed mud and mortar spatter by coverings spread on ground and over wall surfaces.

.2 Protect sills, ledges and projections from mortar droppings.

.3 Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

.3 Exposed masonry units shall be free from all surface indentations, surface cracks and other defects detrimental to the appearance of the finished surface. Units having visual defects will be rejected for exposed areas but may be used for concealed or unfinished areas.

.4 Provide temporary bracing of masonry work, during and after erection, until permanent lateral support is in place.

.5 Make good any damage to masonry work until completion of project.
2.0  PRODUCTS

2.1 Masonry Units

.1 Standard weight concrete masonry units conforming to CSA A165 Series-04, H/15/A/M, and as follows:

.1 Size: Metric modular 200 mm high x 400 mm long x thickness as noted on drawings.

.2 Size: Imperial modular 8" high x 16" long x thickness as noted on drawings.

.1 Natural grey, smooth face units.

.2 Provide specialized sizes and shapes required including purpose made shapes for lintels and pilasters.

.3 Provide bullnose blocks at all exposed external corners, including door opening returns for interior of building locations.

.3 Strength: 15MPa (2175psi) on net area and maximum water absorption of 150 kg/m³ (7.8 lb/ft³).

.4 Fire ratings: Provide concrete blocks having void to solid ratios and concrete types as necessary to achieve required fire rating for thickness of fire rated walls indicated.

.2 Architectural standard weight concrete masonry units conforming to CSA A165 Series-04, H/15/A/M, and as follows:

.1 Size: Metric modular 200 mm high x 400 mm long x thickness, finish and colour as noted on drawings.

.1 Provide specialized sizes and shapes required including purpose made shapes for lintels and pilasters.

.2 Provide standard corner units to provide continuous architectural finish around exterior corners.

.3 Coloured units are to be integrally pre-coloured with colour consistency throughout, from the same production run for each colour.

.2 Strength: 15 MPa (2175 psi) on net area and maximum water absorption of 150 kg/m³ (7.8 lb/ft³).

.3 Fire ratings: Provide concrete blocks having void to solid ratios and concrete types as necessary to achieve required fire rating for thickness of fire rated walls indicated.
2.2 Mortar

.1 Mortar Materials conforming to CSA A179, and the following:
   .1 Water: Clean and potable, free from injurious amounts of acids, alkali and foreign materials.
   .2 Masonry Cement: conforming to CAN/CSA-A3000.
   .3 Aggregate: washed, clean, sharp and free from organic materials.
   .4 Lime: Type S hydrated lime.

.2 Mortar Mixes based on CSA A179, and the following:
   .1 Mortar: Type S cement lime mortar, colour to match masonry units.
   .2 Pre-mixed Mortar: Quality controlled, plant batched and mixed mortar of cementitious materials, sand, water and set retarding agent, with a minimum compressive strength of 30 MPa (4350 psi), calcium chloride free and maximum 0.6% alkali by weight.
   .3 Colour Pigment: Pure synthetic, inorganic, iron oxide coloured mortar pigment.
   .4 Consistency of mortar adjusted by maximum amount of water addition consistent with workability to provide maximum tensile bond strength. Air content in mortar to be kept to a minimum.
   .5 Mortar shall be mixed to an initial flow of 100 to 115, and shall have a flow after suction of not less than 70%.
   .6 All mortar shall be used within two (2) hours of mixing at temperatures over 25°C (77°F) and 2 1/2 hours at temperatures under 25°C (77°F).
   .7 Mortar may be re-tempered within two (2) hours of mixing to replace water lost by evaporation.

.3 Mortar Types based on CSA A179, and the following:
   .1 Mortar for interior and exterior above grade masonry:
      .1 Loadbearing: Type S.
      .2 Non-loadbearing: Type N, with a compressive strength of 5.2MPa (750 psi) at twenty-eight (28) days.
      .3 Unprotected Walls: Type S.
2.3 Grout

.1 Concrete grout for corefills shall conform to CSA A179 and shall be as specified in Section 03 30 00 - Cast-in-Place Concrete.

2.4 Reinforcing, Ties And Accessories

.1 Reinforcement:

.1 Bars: Grade 400W, conforming to CAN/CSA-G30.18 and as specified in Section 03 20 00 - Reinforcing Steel.

.2 Joint Reinforcing: Corrosion resistant, hot dipped galvanized, ladder type, minimum 3.8 mm (9 ga) deformed wire, sized 50mm (2") narrower than wall width.

.2 Masonry Connectors:

.1 Masonry veneer on stud wall ties: corrosion resistant, hot dipped galvanized, 1.5 mm (16ga), flat plate, V-ties and polyethylene insulation supports. Screwed to wall studs at 400 mm (16") o.c. horizontal and 600 mm (24") o.c. vertical.

.2 Masonry veneer on block wall ties: corrosion resistant, hot dipped galvanized, 1.5 mm (16ga), flat plate, V-ties and polyethylene insulation supports. Flush welded to the horizontal joint reinforcement every 400 mm (16") o.c. horizontal and 600 mm (24") o.c. vertical.

.3 Bolts and Anchors:

.1 To sizes and locations as indicated on drawings and to CSA A371.

.4 Control joint filler: Preformed rubber, neoprene or polyvinylchloride, non-bituminous closed cell polyethylene, outsized 50%, resilient, self-expanding.

.5 Soft joint filler and airspace seal: Purpose made, permanently elastic, ultra-high density polyurethane foam impregnated with polymer modified asphalt; density 450 g/m³ (0.45 oz/ft³), colour black.

.1 Soft joint filler shall accept up to 60% compression of original size and retain permanent adhesion to both surfaces.

.2 Provide sizes to suit application in accordance with manufacturer’s recommendations.

.6 Weep hole vents: Purpose made PVC, T-shape, for building into the wall in vertical joint between adjacent units.
3.0 EXECUTION

3.1 Preparation

.1 Establish all lines, levels and coursing and protect from disturbance.

.2 Coordinate all work of this section with others, such as field welding of anchors to steel work, insulation application by others.

.3 Prepare all items to build in as the work proceeds, supplied and either installed by others or installed under this section.

.4 Lay out work to minimize cutting. Avoid the use of less-than-half-size units at corners, jambs and where possible at other locations.

3.2 Workmanship

.1 Do masonry work in accordance with CSA A371 except where specified otherwise.

.2 Build masonry plumb, level, square and true-to-line with vertical joints in proper alignment. Maintain specified tolerances.

.3 Lay out coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum cutting.

.4 Build up walls in uniform manner, no one portion being raised more than 1200 mm (4'-0") above another at any time. Build no more wall vertically in any one day than mortar will support without distress in any joint.

.5 Do not shift or tap units after mortar has taken initial set. If adjustment is required, remove mortar and use fresh mortar.

.6 Make vertical and horizontal joints 10 mm (3/8") thick, except where otherwise indicated or specified. Fill all joints solidly with mortar except where specifically designated to be left open.

.7 Buttering corners of units, throwing mortar droppings into joints, deep or excessive furrowing of bed joints will not be permitted.
.8 Cut masonry units with motor-driven saws to provide clean, sharp, un-chipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full size units without cutting where possible. All units cut with water-cooled saws are to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and cut edges concealed, where possible.

.9 Cut masonry for flush-mounted electrical outlets, grilles, pipes, conduit and other recessed or penetrating items. Leave maximum 3 mm (1/8") clearance.

.10 Keep exposed faces free from stains, chips and cracks. Remove chipped, cracked or otherwise deformed units and replace with undamaged units.

.11 Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

.12 Mix units for exposed masonry from several pallets or cubes as they are placed to produce uniform blend of colour and texture, and to avoid abrupt colour/texture changes, patches and streaks to produce a homogeneous blended appearance. Do not install units that are too contrasting to produce a satisfactory blend. If varying colours and textures are not blended to the Owner’s satisfaction, remove and replace the offending units at no additional cost to the Contract.

3.3 Construction Tolerances

.1 Variation from plumb:

.1 For vertical lines and surfaces of columns, walls and rises, do not exceed 6 mm (1/4") in 3.0m (10'-0").

.2 For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 6 mm (1/4") in 6.0m (20'-0").

.3 For vertical alignment of head joints, do not exceed ±6 mm (1/4") in 3.0m (10'-0"), nor 12 mm (1/2") maximum.

.2 Variation from level:

.1 For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 6 mm (1/4") in 6.0m (20'-0").

.2 For top surfaces of bearing walls, do not exceed 3 mm (1/8") in 3.0m (10'-0"), nor 1.5 mm (1/16") within width of single unit.

.3 Variation from Linear Building Line: For position shown in plan and related portion of columns, walls and partitions, do not exceed 12 mm (1/2") in 6.0m (20'-0").

.4 Variation in the Sizes of Wall Openings: a 6 mm (1/4") maximum variation is allowed from the actual designated size of wall opening.
3.4 **Laying Masonry Walls**

.1 Do not wet concrete masonry units before or during laying.

.2 Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

.3 Provide special shapes as required, such as halves, jambs, corners, etc.

.4 Exterior and interior corners shall be fully bonded. Interior wall intersections shall be masonry bonded or joined with equivalent masonry reinforcement.

.5 Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.

.6 Use full bed of mortar for first course. Bed face shells, cross and end web fully in mortar.

.7 All exposed masonry joints shall be concave, firmly point and compact with 16 mm (5/8”) diameter round bar tool to produce a 10 mm (1/4”) joint.

.8 All concealed joints are to be struck flush.

3.5 **Reinforcement And Anchoring**

.1 Reinforce all concrete unit masonry walls continuously with reinforcing steel both vertically and horizontally in accordance with CSA A371-04. Size and spacing of reinforcement shall be as shown on structural drawings and details.

.1 Horizontal reinforcing bars shall be laid on the webs of the units in a continuous masonry course consisting of bond beam or channel units and shall be solidly grouted in place.

.2 Vertical reinforcing steel shall have a minimum clearance of 6 mm (1/4”) from the masonry, and not less than one bar diameter between bars.

.3 Lap splice as follows for reinforcing steel:

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Lap Splice</th>
</tr>
</thead>
<tbody>
<tr>
<td>10M</td>
<td>600 mm (24&quot;)</td>
</tr>
<tr>
<td>15M</td>
<td>750 mm (30&quot;)</td>
</tr>
<tr>
<td>20M</td>
<td>900 mm (36&quot;)</td>
</tr>
<tr>
<td>25M</td>
<td>1500 mm (60&quot;)</td>
</tr>
</tbody>
</table>
.2 Place horizontal joint reinforcement as per drawings, and as follows:
   .1 Place in first and second mortar joints above and below openings. Extend
       reinforcement minimum 600 mm (24") past openings.
   .2 Place in first and second mortar joints below tops of walls.
   .3 Lap ladder type joint reinforcement a minimum of 200 mm (8").

.3 Masonry reinforcement shall not extend through control joints.

.4 Connect wall ties to back-up for masonry veneer as indicated in 2.4 Reinforcing,
   Ties and Accessories, and as follows:
   .1 Place at maximum 75 mm (3") on centre each way around perimeter of
       openings, within 300 mm (12") of opening.

.5 Coordinate installation of wall ties, anchors and reinforcing with installation of
   cavity wall insulation and/or air/vapour barrier membrane.

3.6 Grouting And Built-In Items

   .1 Set all loose and miscellaneous items of steel and iron, including lintels, shelf-
      angles, bearing plates, door jambs, etc. these items shall be grouted in place.

   .2 Solid fill voids in unit masonry below bearing plates, shelf-angles and beams and
      as indicated on drawings.

   .3 Fill block cells solid with grout as indicated on the drawings and at the following
      locations:
      .1 All ends of walls, both free and abutting other work.
      .2 All jambs of all openings, 2 cells wide at each jamb.
      .3 All fixing locations for fixtures and other work built into or fixed to block
         work, including brackets, bearings, bolts and inserts; fill block cells to
         3 courses below.

   .4 Support all grout in block-cells with expanded metal in bed joint under block.

   .5 Vertical cores shall be cleaned out before grouting.

   .6 Pour grout in 1200 mm (48") maximum lifts with a 15 to 60 minute pause before
      the next lift to permit settlement and absorption of excess water.

   .7 Consolidate grout at time of pouring with a flexible cable vibrator or other approved
      method and then reconsolidate later, before the grout loses its plasticity.

   .8 Do not grout until masonry mortar has cured for at least twenty-four (24) hours.
3.7 Control And Expansion Joints

.1 Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall movement.

3.8 Base Flashings

.1 For unit masonry veneer, install flashing under exterior veneer and as indicated on drawings.

.2 Secure butyl rubber flashing to back-up substrate with adhesive as detailed on drawings.

.3 Lap joints 150 mm (6") and seal with adhesive.

3.9 Pointing And Cleaning

.1 Upon completion, remove any excess mortar and smears that may remain using wood paddles or scrapers.

.2 Pointing: During tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings and at adjacent construction to provide a neat, uniform appearance.

.3 Protect adjacent surfaces and work from damage during cleaning process.

.4 Use only cleaning methods and materials recommended by both the masonry unit and masonry cement manufacturers. Final clean only after mortar is thoroughly set and cured.

.5 Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clean water.

.6 Protect and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION
1.0 GENERAL

1.1 Related Requirements

.1 Cast-in-Place Concrete  

1.2 References

.1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.

.2 Canadian Standards Association (CSA International):

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA S16, Limit States Design of Steel Structures.

.3 CSA S136, North American Specifications for the Design of Cold Formed Steel Structural Members.

.4 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.5 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.

.6 CSA W55, Certification of Companies for Resistance Welding of Steel and Aluminum.

.7 CSA W59, Welded Steel Construction (Metal Arc Welding).

.8 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 ASTM International Inc.:


.3 ASTM F3125/F3125M, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric dimensions.

.4 ASTM A500, Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.5 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless.
.6 ASTM A1011/A1011M, Standard Specifications for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra High Strength.

.7 ASTM A1085/A1085M, Standard Specification for Cold Formed Welded Carbon Steel Hollow Structural Sections (HSS).

.8 ASTM A992, Standard Specifications for Structural Steel Shapes.

.9 ASTM F1554, Standard Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength.

.4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA):

.1 CISC Handbook of Steel Construction.

.2 CISC/CPMA Standard 1-73a, A Quick-drying One-coat Paint for Use on Structural Steel.

.3 CISC/CPMA Standard 2-75, Quick-drying Primer for Use on Structural Steel.

.4 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

.5 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International:

.1 SSPC-SP 1, Solvent Cleaning.

.2 NACE No. 3 / SSPC-SP 6, Commercial Blast Cleaning.

.3 NACE No.4 / SSPC-SP 7, Brush Off Blast Cleaning.

.4 NACE No.2 / SSPC-SP 10, Near White Blast Cleaning.


.6 SSPC Paint Specification No. 20 – Zinc Rich Coating, Type I – Inorganic and Type II - Organic.
1.3  **Quality Assurance**

.1 In accordance with Section 01 43 00 – Quality Assurance.

.2 Qualifications

.1 Structural steel fabricator and erector to be certified by the Canadian Welding Bureau under the requirements of CSA W47.1, Divisions 1 or 2 for fusion welding and/or CSA W55.3 for resistance welding of structural steel components, and to have CWB approved procedure for welding rebar (Grade 400W) to structural steel.

.2 Welders to be CWB approved, working under supervision of a CWB approved firm.

.3 Engage a Professional Engineer licensed in the place where the project is located to be responsible for design, detailing and installation of all connections related to structural steel work.

.4 The Professional Engineer designing connections to hold a Certificate of Authorization, and to carry min. $1,000,000.00 in liability insurance (per occurrence).

1.4  **Quality Control**

.1 Submit in accordance with Section 01 45 00 – Quality Control.

.2 Source Quality Control Submittals:

.1 Submit mill test reports four (4) weeks prior to fabrication of structural steel.

.1 Mill test reports to include ladle analysis and physical test results, and to show chemical and physical properties and other details of steel to be incorporated in project.

.2 The reports to be correlated to the materials or products to which they pertain

.3 Tolerances

.1 Conform to the fabrication and erection tolerances of CAN/CSA S16.

.2 Comply with more stringent tolerances if specified elsewhere to suit interfacing materials or AESS members

1.5  **Unit Prices**

.1 Provide unit prices per Section 01 22 00 – Unit Prices.
1.6 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:

.1 Provide drawings stamped and signed by the Professional Engineer responsible for steel connections.

.2 Before submitting shop drawings, provide a letter signed and sealed by that Engineer stating that he has been engaged to undertake the responsibility for the above. Also submit a copy of that Engineer's Certificate of Authorization, and proof of his liability insurance.

.3 If additional information is required from WSP-S, allow a minimum of five working days for WSP-S to review and respond to the request for information.

.4 It is advisable to submit erection diagrams for review before preparing shop details. Copies of plans and section details developed by WSP-S will not be accepted as erection diagrams.

.3 Erection drawings:

.1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:

.1 Description of erection methods.
.2 Sequence of erection.
.3 Temporary bracings.
.4 Beam sizes (in addition to beam marks).
.5 Connections where threads must be excluded from shear plane.
.6 Details of all field welded connections
.7 Sliding bearing assemblies.
.8 Members which are considered AESS and their category.
.9 Type and finish of bolts in AESS connections.
.10 Side where bolt heads should be placed in AESS connections.
.11 Weld grinding, finish and profile in AESS field connections.

.2 Provide setting drawings showing dimensions and details for placing steel assemblies which are set in concrete,
.4 Fabrication drawings:

.1 Submit fabrication drawings showing designed assemblies, member sizes, components and connections. Show on drawings:

.1 Material specifications.
.2 Surface preparation.
.3 Shop painting / galvanizing.
.4 Section splices.
.5 Types of shop and field connections.
.6 Net weld lengths.
.7 Precautions which will be taken to exclude threads from shear planes of bearing type bolted connections (where applicable).
.8 Vent holes required for galvanizing process.
.9 Camber.
.10 Architectural clearance lines and finishes where connections could encroach other works.
.11 Beam and column web holes required for services and reinforcing around them.

.2 Indicate members which are considered AESS, and their category. Refer to AESS Category Matrix as shown in Table 1 of the CISC Code of Standard Practice, Appendix I.

.1 For AESS bolted connections, indicate bolt type, finish and which side of the connection bolt heads should be placed.

.2 For AESS welded connections, show grinding, profile and weld finish.

.3 Show details by which steel assemblies, which are set in concrete, are to be connected to the formwork.

.4 Substitution of alternative sections will only be allowed provided the new members have equal or greater capacity and stiffness and their dimensions are approved by WSP-S.

.5 When requested, submit sketches and design calculations stamped and signed by the Professional Engineer responsible for connection design.

.6 Provide technical specifications for all sliding bearing assemblies.

.7 On completion of erection, submit a letter signed and sealed by the Professional Engineer responsible for structural steel connections certifying that the work has been completed in accordance with all contract documents.
2.0  PRODUCTS

2.1  Design and Detailing Requirements

1. Design details and connections in accordance with requirements of CSA S16 and CSA S136 to resist forces and to allow for movements indicated. Consider load effects due to fabrication, erection and handling.

2. Connection design to include consideration of all pass-through forces, including tension, compression, moment and shear. Provide local reinforcement at connection or joint as required.

3. Follow conceptual connection details if shown on structural drawings. Do not change without WSP-S written approval. If welds are defined on drawings, the sizes shown are minimum requirements which might need to be increased to suit connection design.

4. Increase specified section thickness at no extra cost if required for fabrication (bending) or galvanizing. Alternatively, build up curved sections from plates.

5. Assume that bolt threads are intercepted by shear plane, unless special measures are indicated on shop drawings to exclude threads from shear plane.

6. Beams:

1. Select beam end connections from CISC "Handbook of Steel Construction" when connection for shear only (standard connection) is required.

2. Typical beam to spandrel beam and beam to column connections to be two sided or end plate connections.

3. Select or design beam end connections for factored shear indicated on plans.

4. When shears are not indicated, select or design non composite beam end connections to resist reaction due to maximum uniformly distributed load capacity of the beam in bending.

5. When shears are not indicated, select or design composite beam end connections to resist one and a half times the reaction due to maximum uniformly distributed load capacity of the non-composite beam section in bending.

6. Where axial forces occur in beams framing to opposite sides of a supporting member, design connections for a pass-through force equal to the smaller axial force. If beam sizes differ, assume the axial force is centred in the smaller beam.

7. Where axial forces occur in beams framing into columns, connect each beam for the axial force shown.
Where no axial force is shown for beam to column connection, design to resist horizontal tension / compression equivalent to 2% of the factored axial force in column, in addition to all other loads.

Seated beam connections to have top clip angles.

End bearing connections of inclined members to have horizontal bearing plane at supported member.

Extend beams bearing on walls for the full length of bearing plates.

For beams continuous over supports and for beams supporting columns, provide min. 6 mm (1/4") stiffener plates at each side of web at point of concentrated load, unless thicker stiffeners are required by connection design or different details are shown on drawings.

Provide all spandrel beams and all floor beams not fully braced by floor construction with top and bottom flange connections for torsional restraint.

Columns:

In addition to all other loads, connect columns to base plates to transfer horizontal load equal to 2% of the column vertical load.

In addition to all other loads, connect columns to base plates to transfer tensile load equal to the capacity of all anchor bolts.

Provide seat angles for joist support at sides of columns continuous through floor.

Provide connection for tie joist bottom chord at all columns supporting joists; coordinate with joist supplier.

Unless otherwise noted on drawings, provide 102 x 102 x 9.5 seat angles attached to sides of columns to support masonry lintels adjacent to columns. Length of seat to equal width of lintel minus 25 mm (1").

Provide connection for masonry wall steel lintels adjacent to columns.

Provide diagonal or cantilevered angles at sides of columns where required to support deck or slab.

Provide cap plates at tops of columns where required for support of deck, slab, joists, beams or roof anchors.

Where columns are built in and stabilized by masonry walls, provide anchors to masonry walls per typical details.
.8 Bracings:

.1 Shape and size gusset plates to accommodate required finishes and clearances; refer to Architectural and Mechanical drawings.

.2 Detail plate and rod bracing connections to be adjustable and to be able to be pre-stressed to approximately 15 MPa.

.3 Design gusset plates and bracing connections for members which are parts of seismic force resisting system to allow ductile rotation and to satisfy requirements of CSA S16. Design gusset plates for other compression members for the force equivalent to twice the specified compression member force, or provide stiffeners to prevent gusset plate buckling.

.9 Moment connections:

.1 Provide moment connections at splices to maintain continuity of cranked beams. Provide header plates or stiffener plates to resist unbalanced flange forces at splices.

.2 Where moment connections are called for but values are not indicated, design for moment capacity of the smaller member in the connection.

.3 Install web and flange stiffener plates at moment connections as required by connection design and detail but in every case when indicated on the drawings. If the shear generated in column web exceeds its shear capacity, reinforce the web.

.10 Holes:

.1 Where holes for services are required through webs of beams or columns, coordinate size and location with Architectural, Mechanical and Electrical drawings, and show on fabrication drawings. Reinforce in accordance with Typical Detail. Alternatively, design reinforcing in accordance with the procedure set forth in the CISC Handbook of Steel Construction, and provide calculations for WSP-S review.

.2 Provide holes in beam flanges or weld threaded studs as required for attachment of wood nailers.

.3 Provide 16 mm (5/8”) diameter weep holes in base plates of HSS columns which are not made watertight.

.4 Provide vent holes in HSS sections where required for galvanizing process. Locate so that any water inside HSS will drain away when HSS is in its final position. Maximum size – 16 mm (5/8”) diameter. Fill holes with vent hole plugs after galvanizing.

.5 Provide 12 mm (1/2”) dia. holes in HSS columns to be filled with concrete. Locate at opposing column faces 150 mm (6”) from each end.

.6 Provide 19 mm (3/4”) dia. vent holes at centerline of all cast in plates supporting columns.

.7 Provide 50 mm (2”) dia. grouting holes in column bearing plates larger than 600 mm x 600 mm (24”x24”).
.11 Built-up members:

.1 Connect together double beams and double channels at not more than 1200 mm (4 ft.) centres unless the members are welded toe to toe.

.2 Connect together axially loaded built-up members in accordance with the requirements of CSA S16. In addition, interconnect compression members for trusses and bracing at least at the one-third points.

.3 Connect cover plates of built-up members to develop the capacity of the built-up member.

.12 Provide all wall supporting members (shelf angles, hangers, stubs, back braces, etc.) which are attached to floor beams with adjustable connections capable to compensate for the deflection of the floor beams due to self-weight of concrete. Anticipate beam deflection to be equivalent to the camber shown, or 20 mm (whichever is more). Alternatively, fabricate based on actual deflected shape of the beams as measured after concrete is poured.

.13 Provide slotted holes long enough to allow for deflection indicated on drawings plus construction tolerance, assuming bolts are centred in slots. Bolts are to be finger-tight with burred threads to allow for movement during the life of structure without bolts loosening.

.14 Do not oversize anchor rod holes for site tolerances. Use hole sizes suggested in the CISC Handbook of Steel Construction.

.15 Design and proportion welded and bolted connections at crane girders and at columns supporting them in accordance with the fatigue requirements of CSA S16 to be able to sustain 2,000,000 cycles of load.

.16 Connect new steel members to existing concrete using drilled concrete anchors, refer to Post Installed Anchors and Dowels notes on drawings. Do not field weld at connections with adhesive anchors.

.17 Provide closure plates for all exposed and for all exterior tubular members.

.18 Design sliding bearing assemblies to accommodate forces and movements shown on drawings.

2.2 Materials

.1 Structural steel:

.1 Rolled shapes: to CSA G40.21 or ASTM A992, refer to drawings.

.2 Hollow structural sections: to ASTM A500, ASTM A1085 or CSA G40.21, refer to drawings.

.3 Structural pipe: to ASTM A53.
2. Anchor rods: CSA G40.21, or ASTM 1554, refer to drawings.


4. Load indicating washers: to ASTM F959.

5. Weldable reinforcing steel: to CSA G30.18, deformed bars.

6. Grating: Galvanized safety grating. Minimum thickness of material 2 mm (0.079"). Banded ends. Bolted connections. Capacity 4.8 kPa (100 psf) unless noted otherwise on drawings. Maximum deflection 1/180th of span.

7. Checker plate: to CSA G40.21, Grade 300W. Plate with rolled-in embossments to provide non-slip surface.

8. Welding materials: to CSA W48 and CSA W59, certified by Canadian Welding Bureau. For members in seismic force resisting system, refer to additional brittleness requirements in CSA S16.


10. Shop paint primer: to CISC/CPMA 275, solvent reducible alkyd, red oxide, compatible with specified topcoat.


12. Hot dip galvanizing: to ASTM A123/A123M, minimum zinc coating of 600 g/m².


15. Sliding bearing assembly: Galvanized top steel plate with a type 304 stainless steel highly polished lower surface and bottom elastomeric pad with a polytetrafluoroethylene (Teflon) upper surface, wrapped in water tight polyethylene wrapping. Static and kinetic coefficients of friction not to exceed 5% under working stress. Assembly to have a working stress capacity of min. MPa on the lower pad. Elastomeric bottom pad to allow a 2% rotation of upper plate and still maintain a substantially uniform bearing pressure between plate and pad. Alternative sliding bearing assembly may be proposed for review by WSP-S.

16. Elastomeric bearing pad: Virgin natural polyisoprene or virgin polychloroprene (Neoprene) conforming to CSA S6.

17. Galvanizing vent hole plug: Grade 6061 Aluminum circular plug.
2.3 Fabrication

.1 Fabricate structural steel in accordance with CSA S16 and with reviewed shop drawings.

.2 Install shear studs in accordance with CSA W59.

.3 Continuously seal hollow members exposed to weather by intermittent welds and plastic filler unless continuous welds are indicated on drawings.

.4 Position beams having permissible mill camber so that the camber is up.

.5 Install stud anchors in shop with end welds in accordance with the recommendations of the stud manufacturer. Lengths of studs given on drawings are the lengths after welding. Replace studs that crack in the weld or shank.

.6 HSS members which require galvanizing to either be per CSA G40.21, grade 350W, Class H, or to be stress relieved prior to galvanizing.

.7 Mill column bearing plates as required to provide full contact bearing and develop column bearing strength.

.8 Complete welded shop connections prior to galvanizing.

.9 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left unpainted, place marking at locations not visible from exterior.

.10 Match marking: shop mark bearing assemblies and splices for fit and match.

.11 Where shop inspection is required, do not ship material to the site before it has been inspected.

.12 Fabricate in stages complex members for which steel inspection is impossible or difficult once completed, and arrange for the Inspection and Testing Agency to do intermediate shop inspections.

.13 Fabricate AESS with tolerances and surface quality consistent with AESS category.

2.4 Shop Painting

.1 Clean all members to SSPC-SP 1 – Solvent Cleaning. Remove loose mill scale, rust, oil, dirt and foreign matter using any suitable method.

.2 In addition for members receiving shop primer paint: Clean steel to SSPC-SP 7 Brush-Off Blast Cleaning.

.3 In addition for members receiving intumescent coating: Clean steel to SSPC-SP 6 Commercial Blast Cleaning.
.4 In addition for members receiving zinc-rich coating: Clean steel to SSPC-SP 10 Near White Blast Cleaning.

.5 Apply one coat of shop paint CISC/CPMA 1-73a to steelwork in the shop with the exception of:

.1 Members to receive spray fireproofing.
.2 Members to receive a finish coat of paint on site for which a CISC/CPMA 2-75 shop primer is required.
.3 Members to receive intumescent coating for which a compatible shop primer is required.
.4 Members to receive zinc-rich coating.
.5 Galvanized members.
.6 Shear connectors and top flanges of composite beams with field welded shear connectors.
.7 Surfaces encased in or in contact with cast-in-place concrete including top flanges of beams supporting slabs.
.8 Surfaces and edges to be field welded for a distance of 50 mm (2") from joints.
.9 Faying surfaces of slip-critical connections.

.6 If members to receive sprayed fireproofing are shop painted, only paints tested to ASTM E736 and approved by spray fireproofing supplier may be used. Any other paint must be removed to bear steel prior to application of spray applied fireproofing.

.7 Apply one coat of compatible primer paint (CISC/CPMA 2-75) in the shop to steelwork to receive a finish coat of paint on site.

.8 If more than one type of paint is specified, each paint to be visually identifiable after application.

.9 Apply galvanizing in the shop to all structural steel located beyond the vapour barrier, including:

.1 Shelf angles and hangers in exterior walls.
.2 Spandrel angles to which precast panels are attached.
.3 Lintels in exterior walls.
.4 Exposed exterior steel members.
.5 Exposed anchor rods.
.6 Other steel noted on drawings.

.10 If galvanized steel is to be painted, use only non-passivated galvanizing process (without chromate coating).

.11 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5°C.

.12 Maintain dry condition and 5°C minimum temperature until paint is thoroughly dry.

.13 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.
3.0 EXECUTION

3.1 General

.1 Structural steel work: in accordance with CSA S16.

.2 Welding: in accordance with CSA W59.

3.2 Connection to Existing Work

.1 Verify dimensions and condition of existing works prior to start of fabrication. Report discrepancies, modify connection details if required and submit to WSP-S for review. Determine any potential interference with existing services and report problem areas to WSP-S for direction before commencing work.

.2 Take precautions to protect existing works from damage. Provide temporary shoring as required. Repair damage to adjacent materials caused by structural steel installation.

3.3 Modification / Removal of Existing Steel Work

.1 A set of Structural Drawings of the existing building may be viewed at the offices of the Architect or WSP-S.

.2 Dismantle and cut existing structural steel as required. Provide temporary shoring and bracing required for these operations. Retain a Professional Engineer to design the temporary shoring and to review this work on-site.

.3 Clean existing structural steel, which is affected by the work and is to remain in place, down to bare metal, prior to its inspection so that its condition may be ascertained. Notify WSP-S when members are ready for inspection.

.4 Remove from site existing steel which is dismantled but not designated for re-use.

3.4 Erection

.1 Erect structural steel in accordance with CSA S16 and reviewed erection drawings.

.2 Do not field cut or alter any members without WSP-S approval.

.3 Make adequate provision for all loads acting on the structure during erection. Provide erection bracing to keep the structure stable, plumb and in true alignment during construction. Bracing members or connections shown on Structural Drawings are those required for the completed structure, and may not be sufficient for erection purposes. For load bearing masonry construction, maintain bracing until completion of masonry work and floor / roof decks which together provide permanent bracing. Do not remove erection bracings without written approval from the Engineer who designed it.
.4 Steel framing to be plumb at temperature of 20°C. If erection is carried out at temperatures greatly differing from 20°C, make adequate provisions; some members may need to be erected out of plumb in order to become plumb when the temperature stabilizes at 20°C.

.5 Set column base plates to the elevation required for grouting using steel shims or leveling screws attached to sides of base plates. Do not fasten leveling nuts to anchor rods. Alternatively, for base plates equal or smaller than 350 mm x 350 mm (14” x 14”), leveling plates set with grout and level to within 1.5 mm (1/16”) across the plate can be used. Do not erect columns upon plates exceeding this tolerance. Lift base plates for inspection when directed.

.6 Grout under column base plates and beam bearing plates as soon as steelwork is completed. Do not add load on steelwork until grouting is completed and grout strength has reached at least 20 MPa.

.7 Do not make permanent connections until structure has been properly aligned.

.8 Install bolts which are not pre-tensioned to be snug tight.

.9 Install bolts in pre-tensioned connections using turn-of-nut method.

.10 Where slotted connections are shown on structural drawings, finger tighten bolts to a snug fit and burr threads to prevent nuts from working loose.

.11 Apply dry lubricant to threads of all galvanized bolts prior to installation.

.12 Pre-stress plate and rod bracing connections to approximately 15 MPa. Adjust connections as required for the pre-stress to be effective when building ambient temperature has stabilized.

.13 Weld beams to bearing plates unless otherwise noted on drawings.

.14 Adjust and finalize connections at wall supporting elements affected by floor beam deflections after concrete is poured.

.15 Provide dissimilar metal separators at connections between aluminum members and structural steel.

.16 Report ill-fitting connections to WSP-S before taking corrective measures.

.17 When welding after galvanizing is in place, grind away galvanizing at areas to be welded.

.18 Do not weld in an ambient temperature below -17°C. Preheat material adjacent to welding areas when ambient temperature is between -17°C and +4°C.

.19 Remove slag from all completed welds so that they may be visually inspected.

.20 Seal members by continuous welds where indicated.
.21 Remove field connection aids from all surfaces which will be exposed to view and where interfering with clearances required by other trades.

.22 AESS members:

.1 Erect using softened slings or other methods to prevent damage.
.2 Provide padding as required to protect while rigging and aligning.
.3 Weld tabs for temporary bracings and safety cabling only at points concealed from view in the complete structure or where approved by the Architect.
.4 Remove all field connection aids added to allow alignment, fit up and welding.
.5 Remove welds at run-out tabs to match adjacent surface.
.6 Plug weld holes for erection bolts.

3.5 Field Painting

.1 Touch up damaged surfaces with the same paint as the shop coat.
.2 Repair any galvanized or zinc rich painted surfaces which have been damaged or field welded in accordance with SSPC Technology Guide No.14.
.3 Clean and prepare surfaces of bolts, which will receive a finished coat of paint in the same manner as the connected steelwork.

3.6 Inspection and testing:

.1 An Inspection and Testing Agency (certified to CSA W178.1 & 2) will be appointed to carry inspection and testing of all structural steel.
.2 Do not commence fabrication until details of inspection have been worked out with the Agency.
.3 Assist the Inspection and Testing Agency in its work. Notify as to the Work Schedule and provide safe access to the work area as required.
.4 The Inspection Agency will submit reports to WSP-S, Contractor and Municipal Authorities covering the Work inspected and provide details of errors or deficiencies observed.
.5 Work will be inspected in shop and when erected. Store fabricated members in shop so that they are accessible for inspection.
.6 Provide Inspection and Testing Agency with a copy of reviewed shop drawings.
.7 Welding inspection:

.1 Welding inspection will be conducted in shop and in field.

.2 The Inspector will check welders’ CWB certification.

.3 The Inspector will review welding procedures for conformance with CWB requirements, manufacturers’ requirements and standard practice.

.4 Arrange for the Inspector to be present during welding of 10% of moment connections and 10% of butt welds in direct tension.

.5 The inspector will visually check all welds at plate girders, all butt welds (including cranks and splices), all welds in moment connections, all welds at crane columns and crane girders, all welds of roof anchors to the base structure, 50% of welds in hanger connections and 20% of all other welds for:

.1 Size, length and profile
.2 Joint preparation, including cleaning and removal of any paint.
.3 Fit-up and alignment.
.4 Penetration and fusion.
.5 Slag removal.
.6 Distortion.
.7 Porosity.
.8 Cracks.

.6 Non-destructive testing will be conducted on the following connections:

.1 All shop and field welded splices.
.2 All welds on crane columns and girders.
.3 A representative 10% of all other welded connections.

.7 Test results will be evaluated in accordance with CSA W59.

.8 Shop inspection will include:

.1 Confirming that all materials meet specifications.
.2 Reviewing mill test reports for conformance with specified material grades.
.3 Checking that mill test reports and producer’s certificates are properly correlated to materials and products supplied for the project and that legible markings were made on the material and products by the producers in accordance with the applicable standards. Where this is not possible, WSP-S may request sample testing to be carried out as described below.
.4 Checking fabricator’s qualification under the requirement of CSA W47

.5 Sampling fabrication procedures for general conformity with Contract requirements.

.6 Reviewing cambering procedure for effect on member capacity.

.7 Checking surface preparation for members to be painted.

.8 Checking shop painting and galvanizing.

.9 General checking:

.1 Dimensions and cross sections in relation to specified member sizes.

.2 Allowable mill sweep and camber.

.3 Locations of all holes, cuts and fittings.

.4 Reinforcement of openings.

.5 Milling of ends for bearing.

.6 Base plate orientation.

.7 Items to be cast in concrete.

.8 Fabrication tolerances.

.9 Splicing (where indicated on drawings).

.10 Cambering.

.11 Surface preparation prior to shop painting.

.12 Compliance with AESS requirements.

.10 Sample testing: When requested, test coupons will be taken and tested in accordance with CSA G40.20 to establish identification. Cut samples from member locations selected by WSP-S and provide to the Inspection and Testing Agency. Make good the locations if requested, at no extra cost, by adding new plates and welds acceptable to WSP-S. The Agency will have the samples tested for mechanical properties and for chemical composition and will classify the steel as to specification.

.9 Field inspection:

.1 Arrange for the Inspector to start field inspection as soon as each section of the Work is completed, plumbed, bolts tightened and field welding finished.

.2 The Inspector will sample erection procedures for general conformity with Contract requirements.

.3 The Inspector will check general fit-up and tolerances and report any apparent distortions and misalignments.
.4 Minimum 10% of columns and 10% of beams will be checked by instruments for plumbness, alignment and elevation.

.5 Field inspection will include:

.1 Checking individual frame members for twisting, sweep and local damage.

.2 Checking levelness of leveling plates.

.3 Inspection of grouting under base plates and bearing plates.

.4 Checking column bearings on cast in plates.

.5 Checking bearings on steel and masonry.

.6 Inspection of sliding bearings.

.7 Inspection of bolting, shear studs and post installed anchors as described below.

.8 Checking installation of permanent bracings and nominal tension in finished building (where specified).

.9 Checking truss permanent bridging and end connections.

.10 Checking that column connections are adjusted to keep the columns plumb after supported structure has deflected due to dead loads applied to floor and roof deck.

.11 Checking that all adjustable connections at wall supporting members have been finalized after concrete is poured.

.12 Inspection of approved field cutting and reinforcing around openings.

.13 Inspection of field painting.

.14 Inspection of field touch-up.

.6 Bolting inspection:

.1 The Inspector will visually check all bolts in bearing connections. Where erection drawings indicate bolts with threads excluded from the shear plane, he will remove nuts from 1% of all bearing bolts and check that thread is excluded from the shear planes.

.2 The Inspector will check that surfaces in slip-critical connections are free from paint and other deleterious substances.
.7 Shear stud inspection:

.1 The Inspector will visually check all stud shear connectors on composite steel beams.

.2 At least on stud in every 150 and all studs which do not have a complete end weld, which are repaired by welding or which show less than the normal reduction in height due to welding will be bent 15 degrees from their axis towards the nearest support, as specified in CSA-W.

.3 Bent studs that show no sign of failure will be accepted and shall remain in the bent position. Studs that crack in weld, base metal or shank will be rejected. Studs with end welds covering less than 85% of the perimeter will be rejected even if they pass the bend test.

.8 Post installed anchor inspection:

.1 The Inspector will sample check drilled concrete and masonry anchors.

.2 The Inspector will provide full time inspection during installation of post installed adhesive anchors subject to sustained tension loads.

.3 The Inspector will randomly select and pull test 5% of all types and sizes of post installed anchors installed on a weekly basis, but not less than one anchor of each type, size and orientation. Pull test to twice the allowable tensile load, or 1.5 times the factored resistance of the anchor given by the manufacturer. Chose anchor locations where proximity to concrete edge does not affect anchor capacity, or use reduced anchor loads per manufacturer’s recommendation. Submit reports to WSP-S within one (1) week of testing. Reports to indicate each anchor location, test load and mode of failure, if applicable. Notify WSP-S immediately if any anchor fails the pull test.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES
  .1  Handrails, balusters, and fittings.

1.2  RELATED SECTIONS
  .1  Section 03 30 00 - Cast-in-place Concrete: Placement of anchors in concrete.

1.3  REFERENCES
  .1  ASTM B211-12e1 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
  .2  ASTM B211M-12e1 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
  .3  ASTM B221M-12a - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  .4  ASTM B221-12a - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  .8  SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.

1.4  PERFORMANCE REQUIREMENTS
  .1  Railing assembly, wall rails, and attachments to resist lateral force of 333 N or 75 lbs at any point without damage or permanent set.
  .2  Fabricate railing assembly, wall rails, and attachments to applicable code requirements.

1.5  SUBMITTALS FOR REVIEW
  .1  Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
  .2  Samples:
     .1  Submit two (2), of finish coating

1.6  QUALITY ASSURANCE
  .1  Perform welding to CSA-W59
Part 2 Products

2.1 ALUMINUM RAILING SYSTEM

.1 Rails: extruded tubing, alloy and temper; size as indicated on drawings, 1-1/2 inch diameter.

.2 Posts: extruded tubing, alloy and temper; size as indicated on drawings.

.3 Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast aluminum.

.4 Mounting: brackets and flanges, with steel inserts for casting in concrete. Prepare backing plate for mounting in wall construction as shown on the drawings.

.5 Splice Connectors: Welding collars, cast aluminum.

.6 Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.2 FABRICATION

.1 Fit and shop assemble components in largest practical sizes for delivery to site.

.2 Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

.3 Provide anchors, and plates required for connecting railings to structure.

.4 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

.5 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

.6 Interior Components: Continuously seal joined pieces continuous welds.

.7 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

.8 Accurately form components to suit ramps and landings to each other and to building structure.

.9 Accommodate for expansion and contraction of members and building movement without damage to connections or members.

.10 Install continuous plastic handrail cover. Heat weld joints and trim smooth.

2.3 FINISHES

.1 Clear Anodic Coating: AAMA 611, Class I, AA-M12C22A41

.1 Location: Exposed aluminum surfaces. Interior Application.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.
.2 Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

.1 Clean and strip aluminum where site welding is required.
.2 Supply items required to be anchored into concrete and placed in partitions with setting templates, to appropriate sections.

3.3 INSTALLATION

.1 Install railings to manufacturer's instructions.
.2 Install components plumb and level, accurately fitted, free from distortion or defects.
.3 Anchor railings to structure with anchors, plates.
.4 Field weld anchors as indicated on Shop Drawings. Touch-up welds with primer. Grind welds smooth.
.5 Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
.6 Assemble with spigots and sleeves to accommodate tight joints and secure installation.

3.4 ERECTION TOLERANCES

.1 Section 01 73 00: Tolerances.
.2 Maximum variation from plumb: 1/4 inch per storey, non-cumulative.
.3 Maximum offset from true alignment: 1/4 inch.
.4 Maximum out-of-position: 1/4 inch.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1  Blocking in wall openings.
.2  Telephone and electrical panel back boards.
.3  Concealed wood blocking for support.

1.2  RELATED SECTIONS

.1  Section 08 11 13 - Metal Doors and Frames: Door openings to receive wood blocking.

1.3  REFERENCES

.2  CSA-O121-17 - Douglas Fir Plywood.
.3  CSA-O141-05 (R2014) - Softwood Lumber.
.4  CSA-O151-17 - Canadian Softwood Plywood.
.5  CSA-O153-13 - Poplar Plywood.
.6  NPA A208.1-2009 - Particleboard.
.7  APA (The Engineered Wood Association) - Product Guide Grades and Specifications.
.8  CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.
.9  NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2010 edition.

1.4  SUBMITTALS FOR REVIEW

.1  Product Data: Provide technical data on wood preservative materials.

1.5  QUALITY ASSURANCE

.1  Lumber Products: Graded and stamped to NLGA requirements.
.2  Plywood Products: Certified and graded to CANPLY requirements.
.3  Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).

Part 2  Products

2.1  MATERIALS

.1  Lumber: NLGA (Standard Grading Rules for Canadian Lumber).

  .1  CSA-O141, softwood SPF species.
  .2  19% maximum moisture content, pressure preservative treat.
.2 Plywood: CSA-O121 (DFP), Grade B; sanded.
.3 Telephone and Electrical Panel Boards: Plywood.

2.2 FASTENERS

.1 Fasteners and Anchors:
  .1 Screws and Nails: Galvanized steel or Electroplated steel; type suitable for application.
  .2 Anchors: Electroplated steel or Galvanized steel; toggle bolt type for anchorage to hollow masonry, expansion shield and lag bolt type for anchorage to solid masonry or concrete, or bolt or ballistic fastener for anchorages to steel.
  .3 Galvanized Coating for Exterior Work: Hot dip galvanized to ASTM A153/A153M.

2.3 FACTORY WOOD TREATMENT

.1 Wood Preservative (Pressure Treatment): CAN/CSA-O80 Series, and in accordance with Table 2 - Use Categories for Specific Products, Uses, and Exposures of CSA-O80.1.
  .1 UC2: Interior construction, above-ground and potentially damp applications; use waterborne alkali-based, type ACQ or CA.
  .2 Wood Preservative (Surface Application): CSA-O80.3, copper naphthenate.

Part 3 Execution

3.1 FRAMING

.1 Set members level and plumb, in correct position.
.2 Place horizontal members, crown side up.
.3 Construct curb members of single pieces.
.4 Space framing at 16 inches on centre.

3.2 SHEATHING

.1 Secure sheathing to framing members with ends over firm bearing and staggered.
.2 Install telephone and electrical panel back boards with plywood sheathing material where required. Size the back board by 12 inches beyond size of electrical panel.

3.3 SITE APPLIED WOOD TREATMENT

.1 Apply preservative treatment to field cuts to manufacturer's written instructions.
.2 Brush apply two (2) coats of preservative treatment on wood requiring cutting or drilling after treatment, and on wood in contact with cementitious materials.
.3 Allow preservative to dry prior to erecting members.
3.4 SCHEDULES

.1 Telephone and Electrical Panel Boards: 3/4 inch thick, square edges, site brush applied preservative treated.

.2 Plywood Sheathing backing to be installed behind gypsum board, for all surface mounted equipment; including Egan Tracks, and any requirements for owner supplied monitors.

.3 Solid wood blocking required behind gypsum board, for wall mounted handrails.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

1.2  RELATED SECTIONS

.1  Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation.

1.3  REFERENCES

.1  CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2  CAN/ULC-S702-14 - Standard for Mineral Fibre Thermal Insulation for Buildings.


1.4  ADMINISTRATIVE REQUIREMENTS

.1  Coordination:

.1  Coordinate with other work having a direct bearing on work of this section.

1.5  SUBMITTALS FOR REVIEW

.1  Product Data: Provide data on product characteristics, performance criteria, limitations.

Part 2  Products

2.1  MATERIALS

.1  Insulation: CAN/ULC-S702, preformed mineral fibre, in batt form; friction fit conforming to the following:

.1  Flame/Smoke Properties: CAN/ULC-S102.

.2  Staples: Steel wire; electroplated or galvanized; type and size to suit application.

.3  Tape: Polyethylene self-adhering type, mesh reinforced, 2 inches wide.

.4  Insulation Fasteners: Steel impale spindle and clip on flat metal base, self-adhering backing, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place.

.5  Wire Mesh: Galvanized steel, hexagonal wire mesh.
Part 3 Execution

3.1 EXAMINATION

.1 Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

.1 Install insulation to insulation manufacturer's written instructions.

.2 Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

.3 Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the surface of insulation.

.4 Install with factory applied vapour retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

.5 Retain in place with spindle fasteners. Place Fasteners at 6 inches on centre maximum.

.6 Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

.7 Wood Framing: Place vapour retarder on warm side of insulation by stapling at 6 inches on centre. Lap and seal sheet retarder joints over member face.

.8 Metal Framing: Place vapour retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

.9 Extend vapour retarder tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Tape seal in place.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1  Tested and listed firestopping systems.

1.2  RELATED SECTIONS

.1  Section 05 12 00 - Structural Steel: Building structural substrate surfaces.
.2  Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.3  REFERENCES

.7  CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.8  CAN/ULC-S102.2-10 - Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.
.10  FM (Factory Mutual) - FM 4991-2001, Approval Standard for Approval of Firestop Contractors.
.11  FCIA (Firestop Contractors International Association) - Manual of Practice.
.13  OPL (Omega Point Laboratories).
1.4 SYSTEM DESCRIPTION

Tested and listed firestopping systems consisting of a material or materials, the wall or floor assembly, and penetrating items or gaps, assembled or placed in spaces, gaps, joints and building perimeters, to restore the fire resistance rating and or smoke resistant properties of a fire resistance rated assembly or smoke resistant assembly.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

Materials, accessories and application procedures listed by ULC, cUL, WHI or OPL, or tested to CAN/ULC-S115 to comply with applicable building code requirements.

Firestopping Materials: CAN/ULC-S101, to achieve a fire rating as noted on Drawings.

Surface Burning Characteristics: CAN/ULC-S102 or CAN/ULC-S102.2, as applicable.

Smoke Resistance: For areas where smoke resistance is required, provide firestop systems with L-ratings of maximum 5.0 cfm/sq ft opening area.

Environmental Resistance: Systems to be resistant to environmental conditions they will be exposed to, as apparent at design stage.

1.6 ADMINISTRATIVE REQUIREMENTS

Coordination: Coordinate with other work having a direct bearing on work of this section.

Sequencing: Coordinate and sequence firestopping installation with all affected trades.

1.7 SUBMITTALS FOR REVIEW

Product Data: Provide manufacturer's written data on product characteristics, performance and limitation criteria.

System Design Listings: Submit system design listings including illustrations from a qualified nationally recognized testing and inspection agency applicable to each firestop configuration.

Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) from firestop manufacturer where no specific third party tested, listed and classified firestop system is available for a particular firestop configuration.

1.8 SUBMITTALS FOR INFORMATION

Installation Data: Manufacturer's written special preparation and installation requirements and tested and listed firestop systems designs.

Contractor's Certificates:
.1 Provide FCIA Member in Good Standing letter or certificate for the current year, on FCIA letterhead.

.2 Current ULC Qualified Firestop Contractor Certificate and individual Designated Responsible Individual Certificate.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Contractor Qualifications: Company specializing in performing the work of this section and as follows:

   .1 FCIA Member in good standing.
   .2 Minimum one (1) person employed at the firm who has passed the ULC Firestop Exam.
   .3 ULC Qualified Firestop Contractor Program.

.3 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer. Obtain firestop systems for complete project, from a single primary firestop systems manufacturer, to the greatest extent possible.

1.10 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire resistance ratings and surface burning characteristics.

.2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials, tested and listed systems or engineering judgments used.

1.11 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver firestopping products in original, unopened containers with labels intact and legible, identifying product and manufacturer.

.2 Store and handle firestopping materials to manufacturer's instructions.

1.12 ENVIRONMENTAL REQUIREMENTS

.1 Do not apply materials when temperature of substrate material and ambient air is below 15 degrees C.

.2 Maintain this minimum temperature before, during, and for three (3) days after installation of materials.

.3 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:
3.2 PREPARATION

.1 Clean substrate surfaces as recommended in manufacturer's written instructions, of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material and performance of firestop system for fire or smoke resistant situations.

.2 Remove incompatible materials which may affect bond.

.3 Install damming and/or backing materials to arrest liquid material leakage.

3.3 APPLICATION

.1 Apply primer and firestopping materials to manufacturer's written instructions.

.2 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to tested and listed system or engineering judgment.

.3 Apply firestopping material in sufficient thickness to achieve rating, to uniform density and texture.

.4 Compress fibred material to achieve a density of 40% of its uncompressed density.
.5 Place intumescent coating in sufficient coats to achieve rating required.

.6 Dam Material: Remove dam material after firestopping material has cured.

3.4 CLEANING

.1 Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION OF FINISHED WORK

.1 Protect adjacent surfaces from damage by material installation.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1 Preparing substrate surfaces.
.2 Sealant and joint backing.

1.2  RELATED SECTIONS

.1 Section 07 84 00 - Firestopping: Sealants required in conjunction with firestopping.
.2 Section 08 11 13 - Metal Doors and Frames: Sealants required in conjunction with door frames.

1.3  REFERENCES


1.4  PERFORMANCE REQUIREMENTS

.1 Sealant Design: Design structural sealant to withstand specified loads without breakage, loss, failure of seals, product deterioration, and other defects.
.2 Design installed sealant to withstand:
   .1 Dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as measured in accordance with ASTM E330.
   .2 Movement from ambient temperature range of 49 degrees C.
   .3 Movement and deflection of structural support framing.
   .4 Water and air penetration.

1.5  ADMINISTRATIVE REQUIREMENTS

.1 Coordination:
   .1 Coordinate with other work having a direct bearing on work of this section.
   .2 Coordinate the work with all sections referencing this section.

1.6  SUBMITTALS FOR REVIEW

.1 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, colour availability.
.2 Shop Drawings: Indicate sealant joints and dimensions, materials, structural bite, glueline thickness, joint profile, and support framing.

1.7 QUALITY ASSURANCE

.1 Perform work to sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

.2 Perform sealant application work to ASTM C1193.

.3 Perform acoustical sealant application work to ASTM C919.

.4 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.5 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.9 WARRANTY

Part 2 Products

2.1 SEALANTS

.1 Acrylic Sealant (Type D): ASTM C920, single component, solvent curing, non-staining, non-bleeding, non-sagging;

.1 Elongation Capability 7.5% to 12%.

.2 Service Temperature Range -28 to 82 degrees C.

.3 Shore A Hardness Range 25 to 50.

.2 Butyl Sealant (Type F): ASTM C1311; single component, solvent release, non-skinning, non-sagging, black colour.

.1 Elongation Capability 7% to 10%.

.2 Service Temperature Range -28 to 82 degrees C.

.3 Shore A Hardness Range 10 to 30.

.3 Acoustic Sealant (Type G): ASTM C1311, Acoustic grade, single component, solvent release, non-skinning, non-sagging, Grey colour.

.1 Elongation Capability 7% to 10%.

.2 Service Temperature Range -28 to 82 degrees C.

.3 Shore A Hardness Range 10 to 30.

.4 Polyurethane Sealant (Type I): single component, chemical curing, non-staining, non-bleeding, non-sagging type;

.1 Elongation Capability 25%.
.2 Service Temperature Range -40 to 82 degrees C.
.3 Shore A Hardness Range 20 to 35.
.5 Silicone Sealant (Type L): single component, chemical or neutral curing, non-sagging, non-staining, non-bleeding,
   .1 Elongation Capability 25%.
   .2 Service Temperature Range -54 to 82 degrees C.
   .3 Shore A Hardness Range 15 to 35.

2.2 ACCESSORIES
   .1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.
   .2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
   .3 Joint Backing: ASTM C1330, round, open cell; polyethylene foam rod, oversized 30% to 50% larger than joint width.
   .4 Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
   .5 Masking tape: Non-staining, non-absorbent type compatible with sealant and adjacent surfaces.
   .6 Setting Blocks and Spacers: Compatible with silicone sealant and recommended by sealant manufacturer.

Part 3 Execution

3.1 EXAMINATION
   .1 Verify that joint openings and substrate surfaces are clean, dry, and free of frost and ready to receive work.
   .2 Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION
   .1 Remove loose materials and foreign matter which might impair adhesion of sealant.
   .2 Clean and prime joints to sealant manufacturer's written instructions.
   .3 Perform preparation to ASTM C1193 for solvent release and latex base sealants.
   .4 Perform preparation to sealant manufacturer's written instructions.
   .5 Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION
   .1 Perform installation in accordance with ASTM C1193 for solvent release and latex base sealants and ASTM C919 for acoustical sealants.
   .2 Install sealant to sealant manufacturer's written instructions.
   .3 Measure joint dimensions and size materials to achieve required width/depth ratios.
.4 Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
.5 Install bond breaker where joint backing is not used.
.6 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
.7 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
.8 Tool joints concave.

3.4 FIELD QUALITY CONTROL
.1 Joint Sealants: Perform adhesion tests to manufacturer's written instructions and ASTM C1193.
.2 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.
.3 Maintain test log and submit report to Consultant indicating tests, locations, dates, results, and remedial actions.

3.5 MANUFACTURER'S FIELD SERVICES
.1 Monitor and report installation procedures, and unacceptable conditions.

3.6 CLEANING
.1 Clean adjacent soiled surfaces.

3.7 PROTECTION OF FINISHED WORK
.1 Remove masking tape and excess sealant.
.2 Protect sealants until cured.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1  Hollow metal steel frames.
.2  Pressed steel doors.

1.2  RELATED SECTIONS

.1  Section 08 71 00 - Door Hardware.
.2  Section 09 91 10 - Painting: Field painting of doors.

1.3  REFERENCES

.1  ASTM A653/A653M-15e1 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.6  ASTM E413-16 - Classification for Rating of Sound Insulation.
.8  CAN/ULC-S105-09 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.
.9  CAN/ULC-S701-11 - Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.10  CAN/ULC-S702-14 - Standard for Mineral Fibre Thermal Insulation for Buildings (Includes Amendment 1, 2012).
.12  CSA-G40.20-13/G40.21-13 - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
.14  CSDMA (Canadian Steel Door Manufacturers Association).

.1  Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2000.
1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:
  .1 Coordinate with other work having a direct bearing on work of this section.
  .2 Coordinate the work with frame opening construction, door, and hardware installation.

.2 Sequencing: Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS FOR REVIEW

.1 Product Data: Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.

.2 Shop Drawings:
  .1 Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.
  .2 Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing.

1.6 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements.

.2 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

.1 Conform to requirements of CSDMA.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 REGULATORY REQUIREMENTS

.1 Fire Rated Door and Frame Construction: Labelled and listed to CAN/ULC-S104.

.2 Fire Rated Door Construction: 45minute ULC Label and as listed on the door and frame schedule.

1.9 DELIVERY, STORAGE, AND PROTECTION

.1 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.

.2 Store in vertical position, spaced with blocking to permit air circulation between components.
.3 Store materials on planks or dunnage, out of water and covered to protect from damage.

.4 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

Part 2  Products

2.1 MATERIALS

.1 Sheet Steel: Galvanized steel to ASTM A653/A653M, commercial grade (CS), Type B.

.1 Interior Doors: Coating designation A40.

.2 Reinforcement: To CSA-G40.20/G40.21, Type 44W, A25 coating designation to ASTM A653/A653M.

2.2 DOOR CORE MATERIALS

.1 Honeycomb Core: Structural small cell 1 inch maximum kraft paper honeycomb; weight 80 lb per ream minimum, density 1.03 pcf minimum, sanded to required thickness.

.2 Polystyrene Core: ASTM C578, Type 1, rigid extruded fire retardant, closed cell board, density 1 to 2 pcf, thermal values R-6.0 minimum.

.3 Polyisocyanurate Core: ASTM C1289, (faced) or ASTM C591 (unfaced), rigid modified polyisocyanurate, closed cell board, 2.0 pcf, thermal value minimum R-11.0.

.4 Temperature Rise Rated (TRR): Core composition to provide fire-protection rating and limit temperature rise on unexposed side of door to 250 degrees C at 30 or 60 minutes, as determined by governing code requirements, core tested as part of a complete door and frame assembly, to CAN/ULC-S104, and listed by a nationally recognized testing agency having a factory inspection service.

2.3 ADHESIVES

.1 Cores and Steel Components: Heat resistant, structural reinforced epoxy, resin based adhesive.

.2 Lock Seam: Reinforced epoxy resin, high viscosity, thixotropic sealant.

2.4 PRIMERS

.1 Primer: Rust inhibitive touch-up only.

2.5 ACCESSORIES

.1 Door Silencers: Single stud rubber/neoprene.

.2 Exterior Top Caps: Rigid polyvinylchloride (PVC) extrusion.

.3 Frame Thermal Breaks: Rigid polyvinylchloride (PVC) extrusion.

.4 Glazing Stops: Formed galvanized steel channel, minimum 5/8 inch high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk tamper proof sheet metal screws.

.5 Bituminous Coating: Fibred asphalt emulsion.
.6 Weatherstripping: Resilient vinyl set in steel frame or aluminum frame.

2.6 FABRICATION - DOORS

.1 Interior Doors: Laminated core construction.
.2 Longitudinal Edges: Continuously welded, filled and sanded with no visible edge seams.
.3 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier.
.4 Reinforce for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware.
.5 Top and Bottom Channels: Inverted, recessed, welded steel channels.
.6 Exterior Door: Flush PVC top caps.
.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

2.7 LAMINATED CORE CONSTRUCTION

.1 Interior Doors: Both face sheets 18 gauge steel with honeycomb core and temperature rise rated core where scheduled, laminated under pressure to face sheets.
.2 Fill voids between vertical stiffeners with fibreglass batt insulation.

2.8 FABRICATION - FRAMES

.1 Interior Frames: 16 gauge thick base metal thickness.
.1 Door Frames and Window Assemblies: Welded type construction.
.2 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier.
.3 Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
.4 Prepare frames for silencers. Provide three (3) single silencers for single doors on strike side. Provide two (2) single silencers on frame head at double doors without mullions.
.5 Configure exterior frames with special profile to receive recessed weatherstripping.
.6 Attach fire rated label to each fire rated door unit.

2.9 ACCESSORIES

.1 Glass: Clear tempered glass, ¼” thick
.2 Glazing Stops: Formed galvanized steel channel, min 5/8” high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk, tamper proof, sheet metal screws.

2.10 FINISHES

.1 Site Painted.
Part 3  Execution

3.1  EXAMINATION

.1 Verify that opening sizes and tolerances are acceptable; check floor area within path of door swing for flatness.

.2 Verify doors and frames are correct size, swing, rating and opening number.

.3 Remove temporary shipping spreaders.

3.2  INSTALLATION

.1 Install doors and frames to CSDMA.

.2 Install fire-rated doors and frames in accordance with NFPA 80, and local authority having jurisdiction.

.3 Coordinate with wall construction for anchor placement.

.4 Coordinate installation of glass and glazing.

.5 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.

.6 Set frames plumb, square, level and at correct elevation.

.7 Secure anchorages and connections to adjacent construction.

.8 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width. Provide vertical support at centre of head for openings exceeding 48 inches in width.

.9 Remove wood spreaders after frames have been built-in.

.10 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

.11 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.

.12 Adjust operable parts for correct clearances and function.

.13 Install glazing and door silencers.

.14 Finish paint as specified in Section 09 91 10.

.15 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.3  ERECTION TOLERANCES

.1 Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

   .1 Flush wood doors; flush configuration; non-rated.

1.2  RELATED SECTIONS

   .1 Section 08 11 13 – Metal Doors and Frames
   .2 Section 08 71 00 - Door Hardware - General.
   .3 Section 09 91 10 - Painting: Site finishing of doors.

1.3  REFERENCES

   .1 ASTM E413-16 - Classification for Rating of Sound Insulation.
   .2 NAAWS 3.1 – North American Architectural Woodwork Standards
   .3 CAN/ULC-S105-09 - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.
   .4 CHPVA (Canadian Hardwood Plywood and Veneer Association) - Official Grading Rules for Canadian Hardwood Plywood-2010.
   .5 HPVA (Hardwood Plywood and Veneer Association).
   .6 NEMA LD3-2005 - High Pressure Decorative Laminates (HPDL).

1.4  ADMINISTRATIVE REQUIREMENTS

   .1 Coordination:

   .1 Coordinate with other work having a direct bearing on work of this section.
   .2 Coordinate the work with door opening construction, door frame and door hardware installation.

1.5  SUBMITTALS FOR REVIEW

   .1 Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
   .2 Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, , factory finishing criteria. Identify cut-outs for glazing.
   .3 Samples:

   .1 Submit two (2) samples of door veneer, min 4 inch in size illustrating stain colour, sheen and pattern.

1.6  QUALITY ASSURANCE

   .1 Perform work in accordance with NAAWS standards, Premium Grade.
.2 Finish doors in accordance with NAAWS standards to finish identified in schedule.
.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION
.1 Package, deliver and store doors in accordance with NAAWS.
.2 Accept doors on site in manufacturer's packaging. Inspect for damage.
.3 Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on site to permit ventilation.

1.8 WARRANTY
.1 Provide warranty to include coverage for failure to meet specified requirements, to the following term:
  .1 Interior Doors: Two (2) years.
  .2 Life of Installation: Interior doors.
.2 Include coverage for warping beyond specified installation tolerances, delamination of veneer, or defective materials].

Part 2 Products

2.1 DOOR LEAF TYPES
.1 Interior Doors: 1-3/4 inches thick; hollow core construction, acoustic rated as indicated.

2.2 DOOR LEAF CONSTRUCTION
.1 Core (Hollow): NAAWS, Type SHC - Standard.

2.3 DOOR FACING
.1 Veneer Facing (Interior Doors): NAAWS Premium quality species wood, to match existing doors.

2.4 ADHESIVE
.1 Facing Adhesive: Type II - water resistant.

2.5 ACCESSORIES
.1 Glazing Stops: Wood, of same species as door facing, channel shape, mitred corners; prepared for countersink style tamper proof screws.
.2 Glass: Clear tempered glass, ¼ inch thick.

2.6 FABRICATION
.1 Fabricate non-rated doors in accordance with NAAWS Standards requirements.
.2 Sound Rating for Single Door Leaf and Frame Assembly: 35, minimum STC.
.3 Provide lock blocks at lock edge for hardware reinforcement.
.4 Vertical Exposed Edge of Stiles: Of same species as veneer facing.
.5 Fit door edge trim to edge of stiles after applying veneer facing.
.6 Bond edge banding to cores.
.7 Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through bolted hardware.
.8 Factory fit doors for frame opening dimensions identified on shop drawings.
.9 Provide edge clearances in accordance with NAAWS.

2.7 FINISHES

.1 Factory finish doors in accordance with NAAWS Standards to the following finishes:
   .1 Catalyzed Polyurethane: Opaque catalyzed polyurethane, Custom quality, Color as per Interior Finish Schedule
   .2 Factory finish doors in accordance with approved sample.
   .3 Seal door top edge with colour sealer to match door facing.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that opening sizes and tolerances are acceptable.
.2 Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

.1 Install doors to manufacturer's instructions.
.2 Install non-rated doors in accordance with NAAWS Standards requirements.
.3 Install fire rated doors to NFPA 80.
.4 Trim non-rated door width by cutting equally on both jamb edges.
.5 Trim door height by cutting bottom edges to a maximum of 3/4 inch.
.6 Machine cut for hardware.
.7 Coordinate installation of doors with installation of frames specified in Section 08 11 13 and hardware specified in Section 08 71 00.
.8 Coordinate installation of glass and glazing.

3.3 INSTALLATION TOLERANCES

.1 Conform to NAAWS requirements for fit and clearance tolerances.
.2 Conform to NAAWS requirements for maximum diagonal distortion.
.3 Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taut string, corner to corner, over an imaginary 36 x 84 inches surface area.

.4 Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 x 84 inches surface area.

.5 Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 x 84 inches surface area.

3.4 ADJUSTING

.1 Adjust door for smooth and balanced door movement.

.2 Adjust closer for full closure.

END OF SECTION
Part 1   General

1.1 SECTION INCLUDES
   .1 Hardware for wood and hollow steel doors.
   .2 Thresholds.
   .3 Weatherstripping, seals, and door gaskets.

1.2 RELATED SECTIONS
   .1 Section 08 11 13 - Metal Doors and Frames.
   .2 Section 08 14 16 - Flush Wood Doors.

1.3 REFERENCES
   .3 CSDMA (Canadian Steel Door Manufacturers Association).
   .4 DHI (Door and Hardware Institute Canada) - AHC and EHC certification programs.
   .5 DHI (Door Hardware Institute) - A115 series.
   .6 DHI - Recommended Locations for Architectural Hardware for Flush Wood Doors (1993).
   .7 BHMA (Builders Hardware Manufacturers Association) - A156 Series Standards.

1.4 ADMINISTRATIVE REQUIREMENTS
   .1 Coordination: Coordinate with other work having a direct bearing on work of this section.
      .1 Coordinate the work with other directly affected sections involving manufacture
         or fabrication of internal reinforcement for door hardware and recessed items.
      .2 Coordinate Owner’s keying requirements during the course of the Work.
   .2 Sequencing: Sequence installation to ensure utility connections are achieved in an
      orderly and expeditious manner.

1.5 SUBMITTALS FOR REVIEW
   .1 Shop Drawings:
      .1 Indicate locations and mounting heights of each type of hardware, schedules, and
         catalogue cuts.
.2 Submit manufacturer's parts lists, and templates.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

.2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

.3 Record Documentation:

   .1 Record actual locations of installed cylinders and their master key code.
   .2 Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

   .1 Provide one (1) extra key lock cylinders for each keyed group.

.2 Tools:

   .1 Provide special wrenches and tools applicable to each different or special hardware component.
   .2 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.8 QUALITY ASSURANCE

.1 Perform Work to the following requirements:

   .1 BHMA A156 series.
   .2 DHI - A115 series.
   .3 DHI WDHS-3.
   .4 CSDMA.
   .5 NFPA 80.
   .6 NFPA 252.
   .7 UL 10B.
   .8 UL 305.
   .9 CAN/C-S132.
   .10 CAN/C-S104.

   .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

   .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

   .4 Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.
1.9 REGULATORY REQUIREMENTS
   .1 Conform to applicable code for Products requiring electrical connection. Listed and classified by CSA or UL as suitable for the purpose specified and indicated.

1.10 DELIVERY, STORAGE, AND PROTECTION
   .1 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.11 WARRANTY
   .1 Provide five (5) year manufacturer warranty for door closers.

Part 2 Products
2.1 KEYING
   .1 Door Locks: Keying will be completed by Owners.

2.2 FINISHES
   .1 Finishes: Identified on the drawings.

Part 3 Execution
3.1 EXAMINATION
   .1 Verify that doors and frames are ready to receive work and dimensions are as indicated on Shop Drawings.

3.2 INSTALLATION
   .1 Install hardware to manufacturer's written instructions.
   .2 Use templates provided by hardware item manufacturer.
   .3 Adjust hardware for smooth operation.

3.3 FIELD QUALITY CONTROL
   .1 Architectural Hardware Consultant will inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's written instructions and as specified.
3.4 PROTECTION OF FINISHED WORK
   .1 Do not permit adjacent work to damage hardware or finish.

3.5 SCHEDULES
   .1 Refer to Hardware Schedule on the drawings.

   END OF SECTION
Part 1  General

1.1  SECTION INCLUDES
   .1  Fixed louvres and frames.
   .2  Bird and Insect screening.
   .3  Blank out sheeting.

1.2  RELATED SECTIONS
   .1  Section 07 62 00 - Sheet Metal Flashing and Trim:  Metal sheeting to blank out unused portions of louvre.
   .2  Section 07 92 00 - Joint Sealants.
   .3  Section 09 91 10 - Painting:  Field painting.
   .4  Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC)
   .5  Division 26 – Electrical

1.3  REFERENCES
   .1  AMCA 500-L-07 - Laboratory Methods of Testing Louvers for Rating.
   .2  ASTM A653/A653M-11 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   .3  ASTM B209M-10 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   .4  ASTM B221-12a - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.4  PERFORMANCE REQUIREMENTS
   .1  Louvre:  To permit passage of air at a velocity of 1.4 m/s (283 FPM) without blade vibration or noise, with maximum static pressure drop of 32.3 Pa.
   .2  Refer to Mechanical Drawings and Specifications for Air velocity and free area requirements.  Free area to have a minimum of 1.2 square feet.

1.5  ADMINISTRATIVE REQUIREMENTS
   .1  Coordination:
      .1  Coordinate the Work with existing curtainwall windows and frames.
      .2  Coordinate the Work with installation of masonry flashings.
      .3  Coordinate the Work with installation of mechanical.
1.6 **SUBMITTALS FOR REVIEW**

.1 Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

.2 Shop Drawings: Indicate louvre layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

1.7 **SUBMITTALS FOR INFORMATION**

.1 Installation Data: Manufacturer's special installation requirements.

.2 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.8 **CLOSEOUT SUBMITTALS**

.1 Operation and Maintenance Data: Include lubrication schedules, adjustment requirements and maintenance.

1.9 **QUALITY ASSURANCE**

.1 Perform Work in accordance with AMCA Certification for louvres.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.10 **WARRANTY**

.1 Provide a twenty (20) year warranty to include coverage for failure to meet specified requirements.

**Part 2**

**Products**

2.1 **MANUFACTURERS**

.1 C/S Louvers; Product: RS-7315.

2.2 **MATERIALS**

.1 Extruded Aluminum: ASTM B221, extruded shape, prefinished with shop applied finish.

.2 Sheet Aluminum: ASTM B209, prefinished with shop applied polyvinylidene fluoride finish.

.3 Steel Sheet: ASTM A653/A653M, galvanized to G90 zinc coating, prefinished with shop applied polyvinylidene fluoride finish.

2.3 **SCREENS**

.1 Insect Screen: 18 x 16 size aluminum mesh, set in aluminum frame.
2.4 ACCESSORIES

.1 Fasteners and Anchors: Stainless steel type.
.2 Primer: Zinc chromate, alkyd type.
.3 Flashings: Sheet steel.
.4 Sealants: as specified in Section 07 92 00.

2.5 FABRICATION

.1 Head and Sill Flashings: Roll formed to required shape, single length in one piece per location.
.2 Screens: Install screen mesh in shaped frame, reinforce corner construction shop install to louvre with fasteners.
.3 Blank-Out Sheeting on Interior of Louvre: Same material as louvre and frame:
   .1 Configuration: Single sheet.

2.6 FINISHES

.1 Exterior Steel Surfaces Screens: Prepainted finish colour to match existing windows.
.2 Exterior Aluminum Surfaces Screen: Prepainted finish; colour as selected colour.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that field measurements are as indicated on Shop Drawings.
.2 Verify that prepared openings and flashings are ready to receive work and opening dimensions are as indicated on Shop Drawings.
.3 Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

.1 Install louvre assembly to manufacturer's written instructions.
.2 Install louvres level and plumb.
.3 Install flashings and align louvre assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
.4 Secure louvres in opening framing with concealed fasteners.
.5 Install insect screen and frame to interior of louvre.
.6 Install perimeter sealant and backing rod in accordance with Section [07 92 00].

3.3 ADJUSTING

.1 Adjust operable louvres for freedom of movement of control mechanism. Lubricate operating joints.
3.4 CLEANING

.1 Strip protective finish coverings.
.2 Clean surfaces and components.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES
   .1  Gypsum board and joint treatment.
   .2  Light gauge metal stud wall framing.

1.2  RELATED SECTIONS
   .1  Section 06 10 13 - Wood Blocking and Curbing.
   .2  Section 07 21 16 - Blanket Insulation: Acoustic insulation.
   .3  Section 07 84 00 - Firestopping.
   .4  Section 09 21 16 - Gypsum Board Assemblies.

1.3  REFERENCES
   .1  ANSI A118.9 - Specifications for Test Methods and Specifications for Cementitious Backer Units.
   .4  ASTM C645-14e1 - Standard Specification for Non-structural Steel Framing Members.
   .5  ASTM C754-17 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
   .6  ASTM C840-17 - Standard Specification for Application and Finishing of Gypsum Board.
   .7  ASTM C1002-16 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  .11  ASTM C1325-17a - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
  .12  ASTM C1396/C1396M-17 - Standard Specification for Gypsum Board.
1.4 SYSTEM DESCRIPTION

1.4.1 Acoustic Attenuation for Interior Partitions: 55 STC to ASTM E90.

1.5 QUALITY ASSURANCE

1.5.1 Perform Work in accordance with GA-216.

1.5.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

1.5.3 Handling Gypsum Board: Comply with GA-801.

1.6 REGULATORY REQUIREMENTS

1.6.1 Conform to applicable code for fire rated assemblies in conjunction with Section 09 22 16 as follows:

1.6.1.1 Fire Rated Partitions: Listed Design Assembly to GA-600 No.

Part 2 Products

2.1 FRAMING MATERIALS

2.1.1 Studs and Tracks: Specified in Section 09 22 16.

2.1.2 Adhesive: GA-216.

2.2 GYPSUM BOARD MATERIALS

2.2.1 Gypsum Board: ASTM C1396/C1396M, paper-faced; 48 inches wide, maximum available length in place; tapered edges, ends square cut.

2.2.1.1 Regular core, 1/2 inch thick.

2.2.1.2 Regular core, 5/8 inch thick.

2.2.1.3 Fire rated core, 5/8 inch thick.
2.3 ACCESSORIES

.1 Acoustic Insulation: CAN/ULC-S702; preformed glass fibre, friction fit type, unfaced.

.2 Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

.3 Corner Beads: ASTM C1047, metal corner bead.

.4 Edge Trim: ASTM C1047; Type L bead.

.5 Joint Materials: ASTM C475.

   .1 Reinforcing tape, adhesive, and water.
   .2 Joint compound: Asbestos-free dust-controlled.

.6 Gypsum Board Fasteners: ASTM C1002, Type S.

.7 Cementitious Board Fasteners: Board manufacturer's purpose made screws, corrosion resistant steel, self-drilling points, counter-sink heads to prevent strip-out, for steel substrate.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 METAL STUD INSTALLATION

.1 Install studs to manufacturer's written instructions.

.2 Metal Stud Spacing: 16 inches on centre.

.3 Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.

.4 Blocking: Nail or screw wood blocking to studs.

3.3 GYPSUM BOARD INSTALLATION

.1 Install gypsum board to manufacturer's written instructions.

.2 Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

.3 Erect single layer fire rated gypsum board, with edges and ends occurring over firm bearing.

.4 Use screws when fastening gypsum board to metal furring or framing.

.5 Place control joints consistent with lines of building spaces as directed.

.6 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

.7 Install backing board over metal studs to manufacturer's written instructions.

.8 Apply gypsum board to curved walls in accordance with GA-216.
3.4 JOINT TREATMENT

.1 Finish to GA-214, Level 5.

.2 Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

.3 Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.

3.5 TOLERANCES

.1 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 in any direction.

END OF SECTION
Part 1 General

1.1 SECTION INCLUDES

.1 Formed metal framing of studs and furring, at interior locations.

.2 Framing accessories.

1.2 RELATED SECTIONS

.1 Section 05 50 00 - Metal Fabrications: Metal fabrications attached to stud framing.

.2 Section 06 10 13 - Wood Blocking and Curbing: Rough wood blocking within stud framing.

.3 Section 07 21 16 - Blanket Insulation: Insulation between framing members.

.4 Section 09 21 16 - Gypsum Board Assemblies: Gypsum board on metal studs for partitioning.

1.3 REFERENCES


.2 ASTM A653/A653M-15e1 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM C645-14e1 - Standard Specification for Non-structural Steel Framing Members.

.4 ASTM C754-17 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.5 ASTM C1002-16 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.6 MPI (Master Painters Institute) - Architectural Painting Specifications Manual and Maintenance Repainting Manual.

.7 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.

1.4 SYSTEM DESCRIPTION

.1 Interior Walls: Metal stud framing assembly with batt type acoustic insulation specified in Section 07 21 16, interior gypsum board specified in Section 09 21 16.

1.5 PERFORMANCE REQUIREMENTS

.1 Exterior Wall Dead and Live Loads: Design and size components to withstand loads caused by positive and negative pressure of wind acting normal to plane of wall.

.2 Maximum Allowable Deflection: 1:180 span.

.3 Wall Assembly:
.1 Design 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.

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

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

1.7 QUALITY ASSURANCE

.1 Perform Work to ASTM C754.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

Part 2 Products

2.1 STUD FRAMING MATERIALS

.1 Framing Assembly Components: ASTM C645.

.2 Studs: ASTM A653/A653M, non-load bearing rolled steel, channel shaped, punched for utility access, as scheduled:

.1 Depth: 6 inches. And 4 inches. As shown on drawings

.2 Thickness: 25 gauge.

.3 Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs.

.4 Ceiling Runners: With extended leg retainer.

.5 Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

.6 Fasteners: Self drilling, self tapping screws.

.7 Acoustic Sealant: As specified in Section 09 21 16.

.8 Touch-Up Primer for Galvanized Surfaces: MPI #18, inorganic zinc-rich primer.

2.2 FABRICATION

.1 Fabricate assemblies of framed sections to sizes and profiles required.

.2 Fit, reinforce, and brace framing members to suit design requirements.

.3 Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.3 FINISHES

.1 Studs Tracks and Headers: Galvanize to Z275 zinc coating designation.
Studs: Electro-galvanize.

Accessories: Same finish as framing members.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that rough-in utilities are in proper location.

3.2 ERECTION

.1 Align and secure top and bottom runners at 24 inches on centre.

.2 Place two (2) beads of sealant between runners and substrate studs and adjacent construction to achieve an acoustic seal.

.3 Achieve an air tight seal between runners and substrate with [acoustic] sealant in conjunction with Section 07 27 00.

.4 Place two (2) beads of acoustic sealant between studs and adjacent vertical surfaces to achieve an acoustic seal.

.5 Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

.6 Install studs vertically at 16 inches on centre.

.7 Align stud web openings horizontally.

.8 Secure studs to tracks using crimping method. Do not weld.

.9 Stud Splicing: Not permissible.

.10 Fabricate corners using a minimum of three studs.

.11 Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

.12 Brace stud framing assembly rigid.

.13 Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.

.14 Blocking: Install blocking for support of hardware and opening frames.

.15 Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

.1 Maximum Variation From True Position: 1/8 inch in 10 ft.

.2 Maximum Variation From Plumb: 1/8 inch in 10 ft.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1 Suspended metal grid ceiling system and perimeter trim.
.2 Acoustic insulation.

1.2  RELATED SECTIONS

.1 Section 07 21 16 - Blanket Insulation.
.2 Section 09 21 16 - Gypsum Board Assemblies: Acoustic partition system.
.3 Section 21 13 00 – Sprinklers. Sprinkler heads in ceiling system.
.4 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC) Air diffusion devices in ceiling system.
.5 Division 26 – Electrical Section: Light fixtures in ceiling system.
.6 Division 27 - Communications: Speakers in ceiling system.
.7 Division 28 – Electronic Safety and Security. Fire alarm components in ceiling system.

1.3  REFERENCES

.2 ASTM C636/C636M-08 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
.4 ASTM E1264-08e1 - Standard Classification of Acoustical Ceiling Products.
.5 CAN/ULC-S702-09 - Standard for Mineral Fibre Thermal Insulation for Buildings (Includes Amendment 1, 2012).
.6 AWCCBC (Association of Wall and Ceiling Contractors of British Columbia).
.7 ULC - Fire Resistance Directory.

1.4  PERFORMANCE REQUIREMENTS

.1 Installed System: Conform to ULC Listed Assembly Design ceiling assembly.
.2 Suspension System: Maximum deflection of 1:360 for acoustic ceiling system including integral mechanical and electrical components.

1.5  ADMINISTRATIVE REQUIREMENTS

.1 Sequencing:
Sequence work to ensure acoustic 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.

Install acoustic units after interior wet work is dry.

**1.6 SUBMITTALS FOR REVIEW**

1. Product Data: Provide data on metal grid system components, and acoustic units.
2. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.
3. Submit reflected ceiling plans for special grid patterns as indicated.
4. Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions, and locations and acoustical unit support at ceiling fixture, lateral bracing

**1.7 MAINTENANCE MATERIAL SUBMITTALS**

1. Extra Stock Materials: Provide 2% of total acoustic unit area of extra tiles to Owner.

**1.8 QUALITY ASSURANCE**

1. Products of This Section: Manufactured to ISO 9000 certification requirements.
2. Conform to AWCCBC requirements.
3. Grid Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
4. Acoustic Unit Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

**1.9 REGULATORY REQUIREMENTS**

1. Conform to applicable code for fire rated assembly and combustibility requirements for materials.

**1.10 ENVIRONMENTAL REQUIREMENTS**

1. Maintain uniform temperature of minimum 16 degrees C, and maximum humidity of 40% prior to, during, and after acoustic unit installation.

**Part 2 Products**

**2.1 MANUFACTURERS - SUSPENSION SYSTEM**


**2.2 MATERIALS**

1. Non-fire Rated Grid: ASTM C635/C635M, intermediate duty; exposed T; components die cut and interlocking.
.2 Fire Rated Grid: ASTM C635/C635M, intermediate duty, listed by ULC for use in a 45 min assembly, exposed T components die cut and interlocking.

.3 Grid Materials: Double web G30 hot-dipped galvanized steel body and cap.

.4 Exposed Grid Surface Width: 15/16 inch.

.5 Grid Finish: Colour White.

.6 Hanger wire: galvanized soft annealed steel wire.

.1 3.6 mm diameter for access tile ceilings.
.2 to ULC design requirements for fire rated assemblies.
.3 2.6 mm diameter for other ceilings.

.7 Hanger inserts: purpose made.

.8 Carrying channels: 38 x 38 mm channel, of 0.5 mm thick galvanized steel.

.9 Wall Mouldings: Hemmed angle mouldings with prefinished exposed flanges.

.10 Accessories: splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.

2.3 MANUFACTURERS - ACOUSTIC UNIT MATERIALS

.1 Armstrong; Product: Cortega, Square Edge. 2’-0” x 4’-0” Panel,

2.4 MATERIALS

.1 Acoustic Tile: ASTM E1264, conforming to the following:

.1 Size: 24”x48”
.2 Thickness: ¾”
.3 ASTE E1264 Classification: Type IV, Form 1 & 2, Pattern E & G.
.4 Composition: Mineral.
.5 Weight: 1.06 lbs / sq.ft.
.6 Thermal Resistance: R-2.2.
.7 Light Reflectance: 0.90%.
.8 NRC Range: 0.7 to 0.75.
.9 Fire Hazard Classification: Class A.
.10 Flame Spread: 25. Smoke Developed: 50.
.11 Edge: Square.
.12 Surface Colour: White.
.13 Surface Finish: Directional fissured

2.5 ACCESSORIES

.1 Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.

.2 Acoustic Sealant: For perimeter moldings, as specified in Section 07 92 00.

.3 Gaskets (for perimeter moldings): Closed cell rubber sponge tape.

.4 Touch-up Paint: Type and colour to match acoustic and grid units.
Part 3    Execution

3.1    EXAMINATION
   .1 Verify that layout of hangers will not interfere with other work.

3.2    INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM
   .1 Install suspension system to manufacturer's written instructions, ASTM C636/C636M, and as supplemented in this section.
   .2 Install system to ASTM E580/E580M.
   .3 Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
   .4 Lay out system to a balanced grid design with edge units no less than 50% of acoustic unit size.
   .5 Locate system on room axis according to reflected plan.
   .6 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
   .7 Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
   .8 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   .9 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected related carrying channels to span the extra distance.
   .10 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
   .11 Do not eccentrically load system, or produce rotation of runners.
   .12 Perimeter Molding:
      .1 Install edge molding at intersection of ceiling and vertical surfaces with continuous gasket
      .2 Use longest practical lengths.
      .3 Overlap and rivet corners.
      .4 Provide concealed molding at junctions with other interruptions.
   .13 Form expansion joints to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.3    INSTALLATION - ACOUSTIC UNITS
   .1 Install acoustic units to manufacturer's written instructions.
   .2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
.3 Lay directional patterned units one way with pattern parallel to room axis as shown on the reflected ceiling plan. Fit border trim neatly against abutting surfaces.

.4 Install units after above ceiling work is complete.

.5 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.6 Cutting Acoustic Units:
  .1 Cut to fit irregular grid and perimeter edge trim.
  .2 Cut bevel edges to field cut units.
  .3 Double cut and field paint exposed edges of tegular units.

.7 Where round obstructions occur, provide preformed closures to match perimeter molding.

.8 Install hold-down clips to retain panels tight to grid 20ft of an exterior door.

3.4 ERECTION TOLERANCES

.1 Maximum Variation from Flat and Level Surface 1/8 inch in 10 ft.

.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 SCHEDULE

.1 Refer to Reflected Ceiling Plan Drawings.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1 Resilient sheet flooring.
.2 Resilient tile flooring.
.3 Resilient base.

1.2  RELATED SECTIONS

.1 Section 09 69 00 - Access Flooring: Recessed floor accessories.
.2 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

1.3  REFERENCES

.4 CAN/ULC-S102.2-10 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.4  SUBMITTALS FOR REVIEW

.1 Product Data: Provide data on specified products, describing performance, physical characteristics; sizes, patterns and colours available.
.2 Shop Drawings: Indicate patterns, seaming plan and borders.
.3 Samples:
   .1 Submit two (2) samples, 12 inch in size illustrating colour and pattern for each floor material for each colour specified.
   .2 Submit two (2) 4 inch long samples of base material for each colour specified.

1.5  SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention.

1.6  CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
1.7 MAINTENANCE MATERIAL SUBMITTALS
.1 Extra Stock Materials: Provide 20 sq ft of flooring, 10 lin ft of base of each material specified.

1.8 QUALITY ASSURANCE
.1 Products of This Section: Manufactured to ISO 9000 certification requirements.
.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
.3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 REGULATORY REQUIREMENTS
.1 Conform to applicable code for flame/smoke rating requirements of ASTM E84.

1.10 DELIVERY, STORAGE, AND PROTECTION
.1 Protect roll materials from damage by storing on end.

1.11 ENVIRONMENTAL REQUIREMENTS
.1 Store materials for three (3) days prior to installation in area of installation to achieve temperature stability.
.2 Maintain ambient temperature required by adhesive manufacturer three (3) days prior to, during, and twenty-four (24) hours after installation of materials.

Part 2 Products

2.1 MANUFACTURERS - TILE FLOORING
.1 Amtico; Product: Spacia Access – Stone – Ceramic Light SX5S1565.
.2 Substitutions: Not permitted

2.2 MATERIALS - TILE FLOORING
.1 Luxury Vinyl Tile: ASTM F1700.
.1 Size: 450 mm x 450mm
.2 Thickness: 5mm
.3 Wear Layer: 0.55mm
.4 Surface Treatment: Urethane coating

2.3 MATERIALS - BASE
.1 Manufacturers:
.1 Johnsonite; Product: 4” Traditional Rubber Base Board. Colour as per Manufacturer’s Standard range. To be determined by Architect.

.2 Johnsonite; Product: Millwork Series Rubber Base– Reveal Profile 6” high. Colour as per Manufacturer’s Standard range. To be determined by Architect.

2.4 ACCESSORIES

.1 Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

.2 Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

.3 Edge Strips: Metal

.4 Cant Strip: Metal.

.5 Sealer and Wax: Types recommended by flooring manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.

.2 Verify concrete floors are dry to a maximum moisture content of 7%, and exhibit negative alkalinity, carbonization, or dusting.

.3 Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

.1 Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

.2 Prohibit traffic until filler is cured.

.3 Vacuum clean substrate.

.4 Apply primer to required surfaces.

3.3 INSTALLATION - SHEET FLOORING

.1 Install sheet flooring to manufacturer's written instructions.

.2 Spread only enough adhesive to permit installation of materials before initial set.

.3 Set flooring in place, press with heavy roller to attain full adhesion.

.4 Lay flooring with joints and seams to produce minimum number of seams.

.5 Terminate flooring at centreline of door openings where adjacent floor finish is dissimilar.

.6 Install edge strips at unprotected or exposed edges, and where flooring terminates.

.1 Secure metal strips before installation of flooring with stainless steel screws.

.2 Secure resilient strips by adhesive.
7. Turn up flooring to form base. Back floor and wall junction with cant strip. Provide cap strip to terminate base.
8. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
9. Install flooring in pan type floor access covers. Maintain floor pattern.
10. At movable partitions install flooring under partitions without interrupting floor pattern.
11. Install edge strips where indicated. Fit joints tightly.

3.4 INSTALLATION - TILE FLOORING
1. Install tile flooring to manufacturer's written instructions.
2. Mix tile from container to ensure shade variations are consistent when tile is placed.
3. Spread only enough adhesive to permit installation of materials before initial set.
4. Set flooring in place, press with heavy roller to attain full adhesion.
5. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.
6. Install tile to pattern to match existing pattern in existing adjacent CSC room. Allow minimum 1/2 full size tile width at room or area perimeter.
7. Terminate flooring at centreline of door openings where adjacent floor finish is dissimilar.
8. Install metal edge strips at unprotected or exposed edges, and where flooring terminates. Secure metal strips before installation of flooring with stainless steel screws.
9. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
10. Install flooring in pan type floor access covers. Maintain floor pattern.
11. At movable partitions install flooring under partitions without interrupting floor pattern.
12. Install feature strips edge strips where indicated. Fit joints tightly.

3.5 INSTALLATION - BASE
1. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.
2. Mitre internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premoulded units.
3. Install base on solid backing. Bond tight to wall and floor surfaces.
4. Scribe and fit to door frames and other interruptions.

3.6 CLEANING
1. Remove access adhesive from floor, base, and wall surfaces without damage.
2. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's written instructions.
3.7 PROTECTION OF FINISHED WORK

.1 Section 01 78 40: Protecting installed work.

.2 Prohibit traffic on floor finish for forty-eight (48) hours after installation.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1  Carpet tile.
.2  Accessories.

1.2  RELATED SECTIONS

.1  Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.
.2  Section 09 65 10 - Resilient Flooring: Base finish.
.3  Section 09 69 00 - Access Flooring.
.4  Division 22 – Plumbing: Plumbing floor cover plate with recess for carpet.
.5  Division 26 - Electrical: Electrical and telephone floor cover plate with recess for carpet.

1.3  REFERENCES

.4  CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.5  CAN/ULC-S102.2-10 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
.6  CRI Carpet Installation Standard - 2011

1.4  SUBMITTALS FOR REVIEW

.1  Product Data: Provide data on specified products, describing performance and physical characteristics; sizes, patterns, colours available, method of installation.
.2  Shop Drawings: Indicate layout of joint.
.3  Samples: Submit two (2) carpet tiles illustrating colour and pattern design for each carpet colour selected.

1.5  SUBMITTALS FOR INFORMATION

.1  Installation Data: Manufacturer's special installation requirements indicating special procedures, perimeter conditions requiring special attention.
1.6 CLOSEOUT SUBMITTALS
   .1 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.7 MAINTENANCE MATERIAL SUBMITTALS
   .1 Extra Stock Materials: Provide 10 carpet tiles of each colour and pattern selected.

1.8 QUALITY ASSURANCE
   .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
   .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
   .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 REGULATORY REQUIREMENTS
   .1 Conform to applicable code for carpet flammability requirements in accordance with ASTM E84.
   .2 Conform to ASTM D2859 for surface flammability ignition test.
   .3 Conform to AATCC 134-06 Electrostatic Propensity of Carpets.

1.10 ENVIRONMENTAL REQUIREMENTS
   .1 Store materials for three (3) days prior to installation in area of installation, to achieve temperature stability.
   .2 Maintain minimum 21 degrees C ambient temperature three (3) days prior to, during and twenty-four (24) hours after installation materials.

Part 2 Products

2.1 MANUFACTURERS
   .1 Shaw Contract Group; Product: Collection: No Rules, Pattern: Intrigue #59558, Colour: Stealth #54595.
      .1 Carpet Tile F1 as identified in Finish Schedule to have the Ecologix Backing.
      .2 Carpet Tile F2 as identified in Finish Schedule to have the “Positile” backing as completed by Tate access flooring. This carpet is to be used in areas with access flooring.

2.2 CARPET TILE
   .1 Carpet Tile: Tufted, Multi-level pattern loop, manufactured in one colour dye lot.
      .1 Tile Size: Nominal 24”x24”
      .2 Thickness: 0.236 inch.
      .3 Colour: Stealth #54595
.4 Pattern: Intrigue #59558,
.5 Pile Fibre: Eco Solution Nylon
.6 Max. Electrostatic Charge: 3 kV. @ 20% R.H.
.7 Gauge: 1/12”
.8 Pile Height: 0.093 inch.
.9 Pile Weight: 19 oz/sq yd.
.10 Density Factor: 9.76 kilotex.
.11 Stitch Count: 9 per inch.
.12 Primary Backing Material: Synthetic.
.13 Secondary Backing Material: Ecoworx Tile.
.14 Size: 24 x24 inches.

2.3 ACCESSORIES
.1 Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
.2 Primers and Adhesives: Recommended by carpet manufacturer and access flooring manufacturer.

Part 3 Execution

3.1 EXAMINATION
.1 Verify existing conditions before starting work.
.2 Verify that surfaces are smooth and flat with maximum variation of 1/4 inch in 10 ft, and are ready to receive work.
.3 Verify concrete floors are dry to a maximum moisture content of 7%; and exhibit negative alkalinity, carbonization, or dusting.

3.2 PREPARATION
.1 Prepare floor to CRI-104.
.2 Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
.3 Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
.4 Vacuum clean substrate.

3.3 INSTALLATION OF FI TILE WITH ECOLOGIX BACKING
.1 Install carpet tile, accessories and adhesive to manufacturer instructions.
.2 Install carpet tile accessories and adhesive in accordance with manufacturer's written instructions.
.3 Integrate and blend carpet from different cartons to ensure minimal variation in colour match.
.4 Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
.5 Lay carpet tile to quarter turn pattern, set parallel to building lines.
.6 Locate change of colour or pattern between rooms under door centerline.
.7 Fully adhere carpet tile to substrate.
.8 Bind cut edges where not concealed by edge strips.
.9 Extend carpet tile as base finish up vertical surfaces to form base. Terminate top of base with cap strip.

3.4 INSTALLATION OF F2 TILE WITH POSITILE BACKING ON ACCESS FLOORING

.1 Access Flooring installation to be completed as per the required specification.
.2 Review access flooring install for squareness, tightness and levelness.
.3 Remove the green plastic plugs completely from each hole using either a flat pain scraper, on insert a flat screw driver into plug and pry out.
.4 The loop pile tiles will have some yarn blossoming at the edges, which is inherent to this type of construction. Face yarn or the strands from the primary may require occasional trimming.
.5 PosiTile seams may be visible depending on style and color. The seams will also blend in over time. Vacuuming with a brush during cleanup is helpful.
.6 During installation and construction do not allow motorized pallet jacks or forklifts to travel on carpet face. Providing a path by exposing the panels is recommended.
.7 Information should be provided to the general contractor, owner and/or furniture installer on the load performance rating of the access floor to protect against damage to the panels due to an overload condition.
.8 Instructions should be provided the general contractor, owner and/or utility installer that panels should be removed only with an approved panel puller, not pried up with a screwdriver. Further, that care should be taken when re-installing panels that the PosiTile carpet on adjacent panels is not caught.

3.5 CLEANING

.1 Remove excess adhesive without damage, from floor, base, and wall surfaces.
.2 Clean and vacuum carpet surfaces.

3.6 PROTECTION OF FINISHED WORK

.1 Do not permit traffic over unprotected floor surface.

3.7 SCHEDULES

.1 Refer to Interior Finish Schedule

END OF SECTION
Part 1 General

1.1 SECTION INCLUDES

.1 Structural floor supported pedestal framing system.
.2 Removable floor panels.
.3 Miscellaneous components.
.4 System electrostatic grounding.

1.2 RELATED SECTIONS

.1 Section 09 65 10 - Resilient Flooring: Finish for access flooring panels. Wall base at floor periphery.
.2 Section 09 68 23 - Carpet - Glue Down: Finish for access flooring panels.
.3 Section 09 68 13 - Tile Carpeting: Finish for access flooring panels.
.4 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC)
Division 26 – Electrical: Electrical raceways, Grounding and bonding of access floor system to building grounding system.

1.3 REFERENCES

.1 ICC A117.1-09 - Accessible and Usable Buildings and Facilities.
.3 CAN/ULC-S102.2-10 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
.4 CISCA (Ceilings & Interior Systems Construction Association) - Recommended Test Procedures for Access Floors.

1.4 SYSTEM DESCRIPTION

.1 Assembly: Access floor system where indicated on the design documents, shall consist of modular and removable fully encased cementitious filled welded steel panels fastened onto and supported by adjustable height pedestal assemblies. Pedestal head and panel corner design must provide a positive location and lateral engagement of the panel to the understructure support system without the use of fasteners.
.2 Access flooring system to achieve finished floor elevation 12 inches nominal height above building structural floor.
1.5 PERFORMANCE REQUIREMENTS

.1 Pedestals:
   .1 Maximum Axial Load: 6000 lb without permanent deformation.

.2 Access Flooring System: Conform to the following:
   .1 Design Load: Panel supported on actual understructure shall be capable of supporting a point load of 1250 lbs applied on a one square inch area at any location on the panel without experiencing permanent set in excess of 0.010 inches.
   .2 Safety Factor: Panel supported on actual understructure system shall withstand a point load of no less the (2) two times the design load rating.
   .3 Ultimate Load: Panel supported on actual understructure shall be capable of supporting a point load of at least 2500 lbs applied through a load indenter on a one square inch area at any location on the panel without failure when tested in accordance with CISCA A/F Section 2, Ultimate Loading.
   .4 Rolling Load: Panel supported on actual understructure system shall be able to withstand the following rolling loads at any location on the panel without developing a local and overall surface deformation greater than 0.04 inches when tested in accordance with CISCA section 3, Rolling Loads. Note wheel 1 and wheel 2 tests shall be performed on two separate panels.
      CISCA Wheel 1: Size: 3” dia x 1 13/16” wide  Load: 1125 lbs. Passes: 10
      CISCA Wheel 2: Size: 6” dia x 2” wide  Load: 875 lbs. Passes: 10,000
   .5 Impact Load: Panel supported on actual understructure shall be capable of supporting an impact load of 150 lbs, dropped from a height of 36” onto a square inch area at any area location on the panel when tested in accordance with CISCA A/F Section 8, Drop Impact Load Test.
   .6 Panel Drop Test: Panel shall be capable of being dropped face up onto a concrete slab from a height of 36”, after which it shall continue to meet all load performance requirements as previously defined.
   .7 Panel Cutout: Panel with an 8” diameter interior cut-out supported on actual understructure shall be capable of maintaining its design load strength with a minimum safety factor of 2 anywhere on the panel without the use of additional supports.
   .8 Flammability: System shall meet Class A Flame spread Requirements for flame spread and smoke development. Test shall be in accordance with ASTM-E84-1998, Standard Test Method for surface burning characteristics for building materials.
   .9 Combustibility: All components of the access floor system shall qualify as non-combustible by demonstrating compliance with requirements of ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.
   .10 Recycled Content: Panel and understructure shall be required to have a minimum post-consumer recycled content of 18% and a minimum total recycled content of 49%.
.11 Overturning Moment: Pedestal support assembly shall provide an average overturning moment of 1000 in-lbs, when glued to a clean, sound, uncoated concrete surface when tested in accordance with CISCA A/F Section 6, “Pedestal Overturning Moment Test”

.12 Maximum Deflection: 0.04 inch.

.3 Lateral Stability: Design system for lateral stability in all directions, with or without panels in place.

.4 Allowable Tolerances:

.1 Flatness of floor panels: plus or minus 0.5 mm in any direction.
.2 Surface Dimension: plus or minus 0.5 mm of all panels.
.3 Finished floor level tolerance: plus or minus 3 mm for overall floor, and plus or minus 1 mm in 2000 mm in any direction.
.4 Squareness: plus or minus 0.5 mm in surface dimension and 0.25 mm measured diagonally.

.5 Surface Electrical Resistance: Maximum one (1) ohm per panel.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with other work having a direct bearing on work of this section.

.2 Pre-installation Meetings: Convene one (1) week before starting work of this section.

1.7 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data for grid system, panels, and accessories; electrical resistance characteristics and ground connection requirements.

.2 Shop Drawings: Indicate floor layout, ramps, appurtenances or interruptions, interruptions to grid, special sized panels, panels requiring drilling or cut-out for services, edge details, registers, elevation differences, size and details of components, anchorage methods, lateral bracing, cut-out details, gasketing, floor finishes, location of connection to building grounding electrode.

.3 Samples: Submit two (2) samples illustrating finishes and colour. Submit samples of access flooring only if providing an approved equal/alternative.

1.8 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements indicating special procedures, perimeter conditions requiring special attention.

.2 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.9 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include recommended cleaning methods, and maintenance procedures.
1.10 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:
    .1 Provide four (4) of each size of floor panel.
    .2 Provide four (4) spare pedestals.
    .3 Provide four (4) stringers.
    .4 Panel Lifting Devices: One (1) of manufacturer's standard type.

1.11 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

.3 Certificates:
    .1 Submit certification, to demonstrate compliance of the access flooring system to specification and specified standards by submitting:
        .1 CSA or ULC certification.
        .2 Government or independent testing agency test reports certifying that the product meets the standard.
        .3 Letter of certification from a responsible official of the manufacturer.
        .4 Method for testing access flooring in accordance with Ceilings and Interior Systems Construction Association (CISCA) standard test procedures. Have tests performed by an independent testing laboratory regularly engaged in testing of access floor components.

    .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

    .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

    .4 Design floor system structure layout for this project under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.12 REGULATORY REQUIREMENTS

.1 Conform to applicable code for flame resistance of panels and electrical ground resistance.

.2 Conform to ANSI A117. for access for the barrier free.

.3 Electrical Grounding Connection: Listed and classified by CSA as suitable for the purpose specified and indicated.
Part 2  Products

2.1  MANUFACTURERS

.1  Tate Access Floors Inc; Product: ConCore 1250 access flooring panels.

.2  Substitutions: Alternatives are allowed, pending the product is equivalent in performance and aesthetic value and is reviewed and approved by Architect.

2.2  SUPPORT COMPONENTS

.1  Pedestals: Tate PosiLock System:

.1  Corrosive resistant steel assembly with minimum 16sq.inches base plate. Pedestal head hot-dipped galvanized steel.

.2  Threaded supporting rod and vibration-proof lock nut to provide a specially designed anti-rotation device, when engaged the head cannot rotate freely, permit 1” (25 mm) adjustment.

.3  Hot dipped Galvanized. Manufacturer's standard finish.

.4  Pedestal assemblies shall provide a means of levelling and locking the assembly at a selected height, which requires deliberate action to change height setting and prevents vibration displacement.

.5  Pedestal head shall be designed with locating tabs and integral shape to interface with the panel for positive lateral retention and positioning without fasteners.

.6  Hot dipped galvanized pedestal base assembly shall consist of a formed steel plate with no less than 16” of bearing area, welded to a 7/8” square steel tube and shall be designed to engage the head assembly.

2.3  PANEL COMPONENTS

.1  Floor Panels: Tate ConCore 1250 Panels

.1  Cementitious core steel floor panel: die formed, reinforced steel top plate, bottom plate filled with cementitious silicate compound, 2’x2’ (610x610mm) size panel, edge trim for carpet. Steel top and bottom sheets must be welded.

.2  Cementitious fill shall be totally encased within the steel welded shell except where cut for special conditions.

.3  Panels shall have an electrically conductive epoxy paint finish.

.4  Corner of panel to have a locating tab and integral shape design to interface with the pedestal head for positive lateral retention and positioning with or without fasteners.

.5  Fastening of panels to pedestal heads shall be accomplished by the use of a machine screw which is specially designed to be self-capturing within the body of the panel.

.6  Top surface shall have 4 positioning location holes to engage positioning buttons on the PosiTile carpet tile for precise matching of the carpet tile to the panel.

.7  Fit between the pedestal head, panel, and screw shall enable an installation with an average panel to panel gap of 0.015”.

.2  Floor Panel Finish Adhesive: Electrically conductive type recommended by floor finish manufacturer.
Perforated Floor Panels: Same material, size, and construction as floor panels with slide dampers for controlled air circulation.

2.4 ACCESSORIES

.1 Fascia Panels: Of laminated construction:
   .1 Front and Back Face Sheets: 1/16” thick extruded Aluminum
   .2 Core: ½” thick plywood.
   .3 Corner pieces, trim, reinforcing, and clip angles.

.2 Ramps: Same materials, structural strength, and construction as floor panels; flush stainless steel cover plates at junction with floor system. Bolted Stringer with Posilock understructure system required at ramps,

.3 Hand Railings: Specified in Section 05 52 00

.4 Hand Railings: Posts and rails of aluminum pipe; assembled with welded connections; cast metal end caps, floor sockets, collars, brackets, and fittings.

.5 Floor Box: Tate Standard Floor Height Standard Capacity PVD Servicenter Box. With receptacle for 2 Duplex Outlets and 2 Voice Data Multiport interface plates. Wiring: CII Modular Connectors or Field Wired (no receptacles). UL rated. Galvanized Steel. 7-5/16” x 6-15/16” Lid Assembly. 1/8” thick low profile trim frame – Lid Colour Black with inset for carpet tile installation. Refer to Electrical Drawings for Locations.

.6 Electrostatic Grounding Connectors: Solid copper.

.7 Cable Cutout Protection: manufacturer's standard type; self-extinguishing.

.8 Gaskets: Closed cell sponge rubber, preformed to suit.

.9 Wall Base: Rubber. Refer to finish schedule.

2.5 FINISHES

.1 Floor Panel Finish: Carpet tile, as specified in Section 09 68 13; colour as selected.

.2 Exposed Metal Surfaces: Baked enamel finish; colour as selected.

.3 Fascia Panel: Baked enamel finish; colour as selected.

2.6 FABRICATION TOLERANCES

.1 Floor Panel Flatness: Plus or minus 0.025 inch along edges

.2 Floor panel Flatness: Plus or minus +/- 0.035 on a diagonal.

.3 Floor Panel Width or Length From Specified Size: Plus or minus 0.01 inch.

.4 Floor Panel Squareness: Plus or minus 0.015 inch difference between opposite diagonal dimensions.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.
.2 Verify field measurements are as shown on Shop Drawings.
.3 Verify that required utilities are available, in proper location, and ready for use.

3.2 PREPARATION

.1 Examine structural subfloor for unevenness, irregularities and dampness that would affect the quality and execution of the work. Do not proceed with installation until structural floor surfaces are level, clean and dry as completed by others.

.2 Concrete sealers, if used, shall be identified and proven to be compatible with pedestal adhesive. Verify that adhesive achieves bond to slab before commencing work.

.3 Verify dimensions on Contract Drawings, including level of interfaces including abutting floor, ledges, and doorsills.

.4 The General Contractor shall provide clear access, dry subfloor area free of construction debris and other trades throughout installation of access floor system.

.5 Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35 to 95 degrees F and relative humidity levels between 20 to 80%. At least 24 hrs before installation begins, all floor panels shall be stored at ambient temperatures between 50 to 90 degrees F and relative humidity levels between 20 to 80% and shall remain within these environmental limits throughout occupancy.

.6 Remove existing moisture sensors, and note existing locations. Moisture sensors to be re-installed after access flooring pedestal installation.

3.3 INSTALLATION

.1 Install components to system manufacturer's instructions.

.1 Installation of access floor shall be coordinated with other trades to maintain the integrity of the installed system. All traffic on the access floor shall be controlled by access floor installer. No traffic but that of the installers shall be permitted on any floor area for 24 hours to allow the pedestal adhesive to set. Access floor panels shall not be removed by any other trades for 72 hours after installation.

.2 Floor system and accessories shall be installed under the supervision of the manufacturers authorized representative and according to manufacturer’s recommendations.

.3 Co-ordinate the installation of Mechanical HVAC Floor Supply Grilles with the Mechanical Contractor.

.2 Pedestal locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with pedestal installation.

.3 Pedestals

.1 Arrange pedestal assemblies to meet grid spacing required.
.2 Bond pedestals base plate to structural floor with adhesive.
.3 When adhesive is cured, no bond impairment acceptable when 178 N horizontal force is applied to 300 mm high pedestals. Install additional pedestal assemblies where grid pattern is disturbed by columns, walls, ramps, openings, and steps, and at cut-outs that impair floor load capacity.
.4 Additional pedestals as needed shall support panels where floor is disrupted by columns, walls, and perimeter cutouts.

.5 No dust or debris producing operations by other trades shall be allowed in areas where the access flooring is being installed to ensure proper bonding of the pedestals to subfloor.

.4 Re-install moisture sensors to existing locations.

.5 Floor panels:

.1 Install floor panels and floor finish solidly on pedestals, level to maximum variation over entire floor of 1:2000.

.2 Install grilles and perforated panels where indicated.

.3 Seal field cuts with plastic angles or channels. No exposed cut edges permitted.

.4 Allow for cutting holes in floor panels for installation of computer equipment, air conditioning units, and supply floor air grilles. Include cable protection edging or sheet.

.5 Partially complete floors shall be braced against shifting to maintain the integrity of the installed system where required.

.6 Understructure shall be aligned such that all uncut panels are interchangeable and fit snugly but do not bind when placed in alternate positions.

.7 Installed panels shall be straight and square and spaced so that the distance from one end to the other of any line of 12 panels is not less than 24 feet and does not exceed 24'-0 1/8”.

.6 Close field cut floor panels with edge trim.

.7 Cut holes in floor panels to accommodate Owner's equipment. Provide cable cut-out protection.

.8 Provide floor and ramps with edge trim and end closures. Provide lateral braces at ramp edges and other locations where pedestals are not brace.

.9 Provide positive electrical earth grounding of entire floor assembly to NFPA 75.

.10 Adhere base to wall at intersection of walls and access floor panels.

.11 Adjust floor panel system for smooth, quiet operation.

3.4 FASCIA PANELS

.1 Install fascia panels at ramp sides.

.2 Secure panels to clip angles attached to structural floor and edge of floor panels.

.3 Install metal trim at intersection of fascia panels and access floor and at abutting walls and columns.

3.5 HAND RAILINGS

.1 Extend railing posts through floor panels to structural floor; secure to flange fittings anchored to structural floor.

.2 Brace posts in position at floor panels with floor collar retainers.
.3 Secure railings at walls with flanged fittings anchored to walls.
.4 Electrically ground railings to access flooring at locations noted by Electrical Engineer.

3.6 ERECTION TOLERANCES
.1 Maximum Out of Level Floor Panel Tolerance: 1/16 inch in 10 ft, non-cumulative.
.2 Gap Between Panels: Installed panels shall be straight and square and spaced so that the distance from one end to the other of any line of 12 panels is not less than 24 feet and does not exceed 24’ 1/8”.

3.7 ADJUSTING
.1 Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.8 PROTECTION OF FINISHED WORK
.1 Do not permit traffic over unprotected floor surface.

3.9 SCHEDULES
.1 Training Rooms 311A & 311B: 24 x 24 inch floor panel, 12” above floor slab, 2 ramps, fascia panels, aluminum hand railing; floor finish Carpet tile – Positile
.2 Storage Room 311C: 24 x 24 inch floor panel, 12” above floor slab; floor finish Carpet tile – Positile.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES
   .1  Surface preparation.
   .2  Painting.

1.2  RELATED SECTIONS
   .1  Section 05 50 00 - Metal Fabrications:  Shop primed items.
   .2  Section 09 72 16 - Vinyl-Coated Fabric Wall Coverings.
   .3  Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC)
   .4  Division 26 – Electrical.  Section 26 05 53 - Electrical Identification.

1.3  REFERENCES
   .1  MPI (Master Painters Institute) - Architectural Painting Specifications Manual and

1.4  ADMINISTRATIVE REQUIREMENTS
   .1  Coordination:  Coordinate with other Work having a direct bearing on Work of this
       section.
   .2  Scheduling:
       .1  Schedule painting operations to prevent disruption of and by other trades.
       .2  Schedule painting operations to prevent disruption of occupants in and about
           building.

1.5  SUBMITTALS FOR REVIEW
   .1  Product Data:
       .1  Submit Product data on all specified finishing products.
       .2  Submit two (2) copies of WHMIS MSDS - Material Safety Data Sheets.
   .2  Samples:
       .1  Submit two (2) samples, 4 inches in in size illustrating selected colours for each
           colour selected.

1.6  SUBMITTALS FOR INFORMATION
   .1  Installation Data:  Manufacturer's special installation requirements including special
       surface preparation procedures and substrate conditions requiring special attention.
   .2  Schedule:
       .1  If requested, submit Work schedule for various stages of Work when painting
           occupied areas for Consultant’s review and Owner’s approval.
1.7 CLOSEOUT SUBMITTALS

.1 Record Documentation: Upon completion, provide itemized list of products used including the following:

.1 Manufacturer’s name.
.2 Product name, type and use.
.3 Colour coding number.
.4 Manufacturer’s Material Safety Data Sheets (MSDS).

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide properly packaged maintenance material as follows.

.1 1 gal of each coating type and colour to Owner.
.2 Label each container with colour, type, texture and room locations in addition to manufacturer’s label.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.2 Installer Qualifications: Qualified journeypersons or apprentices, provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.3 Conform to MPI Painting Manual requirements for materials, preparation and workmanship.

.4 Paint Products: Paint manufacturers and paint Products listed under the Approved Product List section of the MPI Painting Manual.

.5 Inspection and Testing: Painting to be inspected by paint inspection agency (inspector) Use the following clause only when special paint or coating systems are used on a project and/or when the involvement of the specific coating manufacturer is warranted. Clarify this requirement with the manufacturer before incorporating the following clause into the specification.

.6 Special Systems: Where special painting system applications are used, provide manufacturer’s certification of all surfaces and conditions for specific paint or coating system application including inspection and approval of their system application at no additional cost to Owner.

1.10 MOCK-UP

.1 If requested, provide 6 ft long by 6 ft wide field sample panel as specified, illustrating specified coating colour, gloss, texture, and workmanship.

.2 Locate where directed by Consultant.
.3 Approved mock-up will be the acceptable standard of finish quality and workmanship for all painting Work.

.4 Approved mock-up may remain as part of the Work.

1.11 REGULATORY REQUIREMENTS

.1 Conform to applicable code for flame and smoke rating requirements for finishes, storage, mixing, application and disposal of paint and related waste materials.

1.12 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver products to site in sealed and labeled containers showing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.2 Store paint materials at minimum ambient temperature of 7 degrees C and a maximum of 32 degrees C in dry, ventilated area and as required by manufacturer's written instructions.

.3 Provide adequate fireproof storage lockers and warnings as required by authorities having jurisdiction for storing toxic and volatile/explosive/flammable materials.

1.13 SITE CONDITIONS

.1 Ambient Conditions:

.1 Do not perform painting or decorating Work when ambient air and substrate temperatures are below 10 degrees C for both interior and exterior work, or as required by paint product manufacturer.

.2 Do not perform painting or decorating Work when relative humidity is above 85% or when dew point is less than 3 degrees C variance between the air/surface temperature required by paint Product manufacturer.

.3 Provide suitable weatherproof covering and sufficient heating facilities to maintain minimum ambient air and substrate temperatures for twenty-four (24) hours before, during and after paint application.

.4 Do not perform painting and decorating Work when maximum moisture content of substrate exceeds:

.1 Wood: 15%.

.2 Plaster and Gypsum Wallboard: 12%.

.3 Masonry, Concrete, and Concrete Unit Masonry: 12%.

.4 Concrete Floors: 8%.

.5 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.

.6 Test concrete, masonry and plaster surfaces for alkalinity as required.

.7 Provide minimum lighting level of 30 ft candles is provided on surfaces to be painted or decorated.
1.14 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials in accordance with Local authorities having jurisdiction.

.2 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.3 Place non-reusable materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce contaminants entering waterways, sanitary/storm drain systems or into the ground, adhere to the following procedures:
   .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
   .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
   .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
   .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
   .5 Dry out empty paint cans prior to disposal or recycling.
   .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.5 Set aside and protect surplus and uncontaminated finish materials and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.15 WARRANTY

.1 Provide local MPI Accredited Quality Assurance Association two (2) year guarantee warranting that Work has been performed in accordance with MPI Painting Manual.

Part 2 Products

2.1 MATERIALS

.1 Use only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers) listed in the latest edition of the MPI Approved Product List (APL) on this project.

.2 Ancillary materials such as linseed oil, shellac, thinners, solvents to be of highest quality product and provided by an MPI listed manufacturer, and compatible with paint materials being used.

.3 Where required, use only materials having a minimum MPI "Environmentally Friendly" E2 or better rating based on VOC (EPA Method 24) content levels.

.4 Where indoor air quality (odour) is an issue, use only MPI listed materials having a minimum E2 or better rating.

.5 Where possible, all materials to be lead and mercury free with low VOC content.

.6 Provide all material for each system from a single manufacturer.
.7 Fire Hazard: Flame spread and smoke developed ratings in accordance with local authorities having jurisdiction.

.8 Patching Materials: Latex filler.

.9 Fastener Head Cover Materials: Latex filler.

2.2 MIXING AND TINTING

.1 Coatings: Ready-mixed and pre-tinted; re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.2 Paste, Powder or Catalyzed Paint: Mixed in accordance with manufacturer's written instructions.

.3 Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

.1 Do not exceed paint manufacturer's recommendations for addition of thinner. Do not use kerosene or any such organic solvents to thin water-based paints.

.2 Thin paint for spraying in accordance with paint manufacturer's instructions.

2.3 FINISH AND COLOUR

.1 Finish: To MPI Premium Grade finish requirements.

.2 Colours and Finishes: Refer to Finish Schedule on Drawings.

.1 Interior Colours: Based on three (3) base colours and three (3) accent colours with a maximum of one (1) deep or bright colour. No more than eight (8) colours will be selected for entire project.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as the sheen rating of applied paint with the following values:

<table>
<thead>
<tr>
<th>Gloss Level</th>
<th>Description</th>
<th>Gloss @ 60 degrees</th>
<th>Sheen @ 85 degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Matte Finish (flat)</td>
<td>0 to 5</td>
<td>10 max.</td>
</tr>
<tr>
<td>G2</td>
<td>Velvet-Like Finish</td>
<td>0 to 10</td>
<td>10 to 35</td>
</tr>
<tr>
<td>G3</td>
<td>Eggshell Finish</td>
<td>10 to 25</td>
<td>10 to 35</td>
</tr>
<tr>
<td>G4</td>
<td>Satin-Like Finish</td>
<td>20 to 35</td>
<td>35 min.</td>
</tr>
<tr>
<td>G5</td>
<td>Traditional Semi-Gloss Finish</td>
<td>35 to 70</td>
<td></td>
</tr>
<tr>
<td>G6</td>
<td>Traditional Gloss</td>
<td>70 to 85</td>
<td></td>
</tr>
<tr>
<td>G7</td>
<td>High Gloss Finish</td>
<td>More than 85</td>
<td></td>
</tr>
</tbody>
</table>

.2 Gloss level ratings of painted surfaces as noted on Finish Schedule.

2.5 INTERIOR PAINT SYSTEMS

.1 Wood - Transparent:

.1 Filler coat (for open grained wood only).

.2 Two (2) coats of stain.
.3 One (1) coat clear protective finish sealer.

.2 Plaster, Gypsum Board:
   .1 One (1) coat of alkyd primer sealer.
   .2 Two (2) coats of latex enamel, eggshell finish.

2.6 INTERIOR PAINT SYSTEMS

.1 Paint interior surfaces in accordance with the following MPI Painting Manual requirements.
.2 Structural Steel and Metal Fabrications: (columns, beams, joists, etc.).
   .1 INT 5.1A: Quick dry enamel semi-gloss finish.
   .2 INT 5.1B: Water based light industrial, G6 coating.
   .3 INT 5.1Q: Latex (over alkyd primer), G6 finish.
   .4 INT 5.1R: High performance architectural latex, G6 finish.
   .5 INT 5.1S: Institutional low odor/low VOC, G6 finish.
.3 Steel - High Heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc.,
   with temperature range as noted).
   .1 NT 5.2A: Heat resistant enamel finish, maximum 205 degrees C.
.4 Galvanized Metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts,
   etc.).
   .1 INT 5.3B: Water based light industrial, G6 coating.
   .2 INT 5.3M: High performance architectural latex, G6 finish.
   .3 INT 5.3N: Institutional low odor/low VOC, G6 finish.
.5 Aluminum: (unanodized).
   .1 INT 5.4D: Aluminum paint finish.
.6 Dressed Lumber: (including doors, door and window frames, casings, molding, etc.).
   .1 INT 6.3C: Semi-transparent stain finish.
   .2 INT 6.3E: Polyurethane varnish (over stain), G4] finish.
   .3 INT 6.3K: Polyurethane varnish, G4 finish.
   .4 INT 6.3Q: Water based varnish, clear, G6 finish.
   .5 INT 6.3W: Water based varnish (over stain), clear, G4 finish.
.7 Plaster and Gypsum Board: (gypsum wallboard and textured finishes).
   .1 INT 9.2B: High performance architectural latex, G3 finish.
Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

.2 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

.3 Test shop applied primer for compatibility with subsequent cover materials.

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

3.2 PREPARATION

.1 Prepare surfaces in accordance with MPI requirements.

.2 Remove and store miscellaneous hardware and surface fittings such as electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to painting. Clean and replace upon completion of painting Work in each area.

.3 Protect adjacent surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, from painting operations with drop cloths, shields, masking, templates, or other suitable protective means.

.4 Correct defects and clean surfaces which affect work of this section. Start of finish painting of defective surfaces indicates acceptance of substrate and making good defects will be at no cost to Owner.

.5 Confirm preparation and primer used with fabricator of steel items.

.6 Seal with shellac and seal marks which may bleed through surface finishes.

.7 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

.8 Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

.9 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

.10 Concrete Floors: Remove contamination; acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

.11 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

.12 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
.13 Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

.14 Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

.15 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

.16 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

.17 Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

.18 Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

.19 Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

### APPLICATION

.1 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.

.2 Apply products to adequately prepared surfaces, within moisture limits and acceptable environmental conditions.

.3 Apply paint finish in areas where dust is no longer being generated or when wind or ventilation conditions will not affect quality of finished surface.

.4 Apply each coat to uniform finish.

.5 Tint each coat of paint progressively lighter to enable confirmation of number of coats.

.6 Unless otherwise approved, apply a minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.

.7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 39 inch.

.8 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.9 Allow applied coat to dry before next coat is applied.

.10 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
.11 Continue paint finish behind wall-mounted items such as chalk and tack boards.

.12 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25% with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to Section 23 05 53 and Section 26 05 53 for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Unless otherwise specified, paint all unfinished conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces in the following areas:

.1 Exposed-to-view exterior and interior areas.

.2 High humidity interior areas.

.3 Boiler room, mechanical and electrical rooms.

.3 In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish; touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Paint inside of ductwork and convector and baseboard heating cabinets where visible behind louvers, grilles and diffusers for a minimum of 18 inch or beyond sight line, whichever is greater, with primer and one (1) coat of matt black (non-reflecting) paint.

.7 Paint the inside of light valances gloss white.

.8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.9 Paint red or band all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.

.10 Paint yellow or band all natural gas piping in accordance with mechanical specification requirements.

.11 Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Paint exterior steel electrical light standards. Do not paint outdoor transformers and substation equipment.

.13 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.5 FIELD QUALITY CONTROL

.1 Provide inspection by Paint Inspection Agency (inspector) acceptable to the specifying authority for all surfaces.

.2 Acceptable Surfaces:
.1 No visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inch.

.2 No visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inch.

.3 No visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.

.4 Uniformity of colour, sheen, texture, and hiding across full surface area.

3.6 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.7 SCHEDULE - COLOURS

.1 Refer to Interior Finish Schedule

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES
    .1  Marker boards.
    .2  Accessories.

1.2  RELATED SECTIONS
    .1  Section 09 21 16 - Gypsum Board Assemblies: Preparation of substrate and adjacent work to receive work of this section.
    .2  Section 06 10 13 - Wood Blocking and Curbing: Wood grounds.

1.3  REFERENCES
    .1  APA (The Engineered Wood Association) - Product Guide Grades and Specifications.
    .2  ASTM A424/A424M-09a - Standard Specification for Steel, Sheet, for Porcelain Enameling.
    .3  ASTM C1396/C1396M-13 - Standard Specification for Gypsum Board.
    .5  CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
    .6  CAN/ULC-S706-09 - Standard for Wood Fibre Insulating Boards for Buildings.
    .7  PEI-1001 (ALS-100) - Specifications for Architectural Porcelain Enamel.

1.4  ADMINISTRATIVE REQUIREMENTS
    .1  Coordination:
        .1  Coordinate with other work having a direct bearing on work of this section.
        .2  Coordinate the Work with installation of wall outlets and switches that are within the wall space for Work of this section.

1.5  SUBMITTALS FOR REVIEW
    .1  Product Data:  Provide data on marker boards and trim and accessories.
    .2  Shop Drawings:  Indicate wall elevations, dimensions, joint locations, special anchor details.

1.6  CLOSEOUT SUBMITTALS
    .1  Operation and Maintenance Data:  Include data on regular maintenance cleaning, stain removal.

1.7  DELIVERY, STORAGE, AND PROTECTION
    .1  Protect pre-finished surfaces with strippable coating.
1.8 **WARRANTY**

.1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.

.2 Warranty: Include coverage of marker board surfaces from crazing or cracking, and from discoloration due to cleaning.

**Part 2 Products**

2.1 **MANUFACTURERS**

.1 Egan System; Product: Egan System Track and Egan System Markerboard. 12’-0” long track, c/w 3 whiteboards sized 4’-0” x 3’-0” each.

2.2 **MARKER BOARD MATERIALS**

.1 Sheet Steel: ASTM A653/A653M, commercial quality, galvanized to Z275 coating designation.

.2 Aluminum Sheet: ASTM B209, 6063 alloy, T52 temper.

2.3 **ACCESSORIES**

.1 Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

2.4 **FABRICATION - MARKER BOARDS**

.1 Outer Face Sheet: Steel, 22 gauge

.2 Core: Particle board 3/8 inch thick.

.3 Backing Surface: Steel, 28 gauge thick.

.4 Backing Surface: Aluminum sheet, 0.015 inch thick.

.5 Backing Surface: Aluminum foil, 0.002 inch thick.

.6 Splice Joint: Concealed spline of sheet steel.

2.5 **FABRICATION - FRAME AND TRIM**

.1 Aluminum Track: exposed fasteners, over marker board surfaces.

.2 Aluminum Chalk Rail: one piece full length of chalk board, closed ends; concealed fasteners.

2.6 **FINISHES**

.1 Porcelain Enamel: Glass fibred enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; colour white

.2 Baked Enamel: Thermosetting resin enamel, reinforced with magnesium silicate and silicone carbide, colour white.

.3 Slate: Machine ground to smooth surface.

.4 Aluminum Frame: Clear Anodized
.5 Concealed Steel Items: Galvanized to 2.0 oz/sq ft with coating thickness.

.6 Apply one (1) coat of bituminous paint to concealed metal surfaces in contact with cementitious or dissimilar materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verify dimensions, tolerances, and method of attachment with other work.

.2 Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on Shop Drawings.

.3 Verify flat wall surface for frame-less adhesive applied type.

3.2 INSTALLATION

.1 Install marker boards to manufacturer's written instructions.

.2 Establish top track at 81 inches above finished floor.

.3 Secure units level and plumb.

.4 Marker Boards

.1 Butt panels tight with concealed spline to hairline joint.

.2 Join chalk board panels with batten joint.

.3 Set slate chalk board tight in frame, butt joints tight, hairline.

3.3 CLEANING

.1 Remove protective material from surfaces.

.2 Clean chalk board surfaces in accordance with manufacturer's written instructions, then cover chalk board surfaces with protective cover, taped to frame.

.3 Remove temporary protective cover at date of Substantial Completion.

3.4 PROTECTION OF FINISHED WORK

.1 Protect finished Work from damage.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES
   .1  Sliding panel acoustic partition.
   .2  Ceiling track and operating hardware.
   .3  Manual operation.

1.2  RELATED SECTIONS
   .1  Section 05 50 00 - Metal Fabrications, 05 12 00 - Structural Steel: Overhead track structural support framing.
   .2  Section 06 10 13 - Wood Blocking and Curbing: Wood blocking and track support shimming.
   .3  Section 08 71 00 - Door Hardware - General: Lock cylinders for panels.
   .4  Section 092116 - Gypsum Board Assemblies: Door pocket construction for panel partitions.
   .5  Section 09 51 13 - Acoustic Panel Ceilings: Adjacent ceiling finish.
   .6  Section 09 91 10 - Painting: Field applied paint finish to panels.
   .7  Section 07 21 16 - Blanket Insulation: Acoustic barrier placed between top of partition track and roof deck above.

1.3  REFERENCES
   .3  ASTM E413-10 - Classification for Rating of Sound Insulation.
   .6  CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
   .7  ULC - Fire Resistance Directory.
   .8  UL - Fire Resistance Directory.

1.4  PERFORMANCE REQUIREMENTS
   .1  Fire Rated Partition Assembly: Not Required.
.2 Sound Transmission Coefficient (STC): 50 STC measured in accordance with ASTM E90, tested on panel size of 100 sq ft.

.3 Surface Burning of Vinyl Fabric Finish: Class “A” rated material. ASTM E84; flame spread/smoke developed rating of 25.

.4 Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

.5 Operation: Centre opening; paired panels; centre stacking.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:
  .1 Coordinate with other work having a direct bearing on work of this section.
  .2 Coordinate the work with other sections providing panel finish materials to this section.

1.6 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data on partition operation, hardware and accessories, track components, finishes, & colours.

.2 Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, finish trim, stacking sizes, adjacent construction.

.3 Samples:
  .1 Submit two (2) samples of manufacturer's full colour range for selection of colours.
  .2 Submit two (2) samples of surface finish, 12 x 12 inches size, illustrating quality, colours selected, texture, and weight, and fire spread rating.

1.7 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention, installation sequence.

.2 Manufacturer's Certificate: Certify that partition system meets or exceeds specified acoustic requirements of STC 50.

1.8 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data:
  .1 Include recommended cleaning methods, cleaning materials, and stain removal methods.
  .2 Describe cleaning materials detrimental to all surfaces and hardware finish.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
1.10 REGULATORY REQUIREMENTS

.1 Conform to applicable code for combustibility requirements for materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Modernfold Inc; Product: Acousti-Seal #932 Paired flat panels, hinged in pairs, manually operated, top supported with automatic floor seals and expandable closure. 50 STC rating. 8lbs/sqft. Complete with Type II – acoustically rated pocket doors.

.2 Substitutions: Are permitted, the review and approval by both the Client and Architect, for an equivalent performing and aesthetic product.

2.2 COMPONENTS

.1 Panel Construction:

.1 Panel Substrate Facing: 16ga Steel sheet.

.2 Skin: 0.5” NAUF medium density fiberboard, single material or composite layers continuously bonded to panel frame. Acoustic ratings of this panel shall be a minimum of 50 STC rating.

.3 Core: 16 gauge formed sheet steel frame top, bottom, jambs, and intermediates; welded construction; internally reinforced at suspension points. Frame is designed so that full vertical edges of panels of formed steel and provide concealed protection of the edges of the panel skin.

.4 Thickness: Nominal 3” thick, standard width is 48”, height is 10’-0”.

.5 Trim: No vertical trim required or allowed on edges of panels. Minimal groove appearance at panel joints.

.6 Hinges: Full leaf butt hinges, attached directly to the panel frame. Welded hinge anchor plates within panel shall further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.

.7 Panel to Panel Seals: Roll formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic astragals in only one panel edge are not acceptable. [Grooved and gasketed astragals]; continuous flexible ribbed vinyl seal fitted to panel edge construction; colour to match panel finish.

.2 Track: Modernfold: #17 Suspension system. Minimum 11ga, 0.12” roll formed steel; supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38” diameter thread rods.

.3 Carriers: Ball bearing, steel wheels on trolley carrier at top of every panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.
Acoustic Seals: Horizontal top Seals to be continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts. Horizontal bottom seals shall be Modernfold IA2 Bottom seal. Automatic operable seals providing nominal 2” operating clearance with an operating range of +0.5” to -1.5” which automatically drop as panels are positioned without the need for tools or cranks.

Accessories: Exposed steel, pre-painted off-white track soffit. Final Closure to be a horizontally expanding panel edge with removeable crank.

Pocket Enclosure Walls: to match adjacent walls. Refer to Interior Finish Drawings.

Pocket Door: Type II Double door, acoustically rated. Door, frame, and trim finish as noted on Interior Drawings. Finishes to be determined by Architect and selected from the manufacturer’s standard range.

Pass Door: None required.

2.3 PANEL FINISHES

Facing Vinyl coated fabric specified in Section 09 72 16.

Vinyl Coated Fabric Finish: Mildew resistant, polyvinyl fluoride finish for washability and improved flame retardance; colour as selected from manufacturer's standard range.

Part 3 Execution

3.1 EXAMINATION

Verify attachment substrate and site conditions.

Verify that field measurements are as indicated on Shop Drawings.

Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

Verify floor flatness of 1/8 inch/10 ft, non-cumulative.

Verify wall flatness of 1/8 inch/10 ft, non-cumulative.

3.2 PREPARATION

Verify that required utilities are available, of the correct characteristics, in proper location, and ready for use.

3.3 INSTALLATION

Install partitions to manufacturer's written instructions and ASTM E557.

Install operable partitions and accessories after other finishing operations, including painting have been completed.

Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

Fit and align partition assembly level and plumb.

Lubricate moving components.
Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.4 ADJUSTING

.1 Adjust partition assembly to provide smooth operation from stacked to full open position. Partitions should operate smoothly, easily and quietly, free from binding, war, excessive deflection, distortion, nonalignment, misplacement, disruption, malfunction, throughout entire operational range. Lubricate hardware and other moving parts. Do not over-compress acoustic seals.

.2 Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

.3 Adjust to achieve light tight seal.

3.5 CLEANING

.1 Clean finish surfaces and partition accessories.

3.6 CLOSEOUT ACTIVITIES

.1 Demonstration: Demonstrate operation of partition, identify potential operational problems, maintenance procedures to Owner’s representative(s)

.2 Provide Operation and Maintenance Manual to Owner’s representative(s).

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

.1 Corner guards.

1.2  RELATED SECTIONS

.1 Section 05 52 00 - Metal Railings.
.2 Section 06 10 13 - Wood Blocking and Curbing: Support blocking for wall and corner guard anchors.
.3 Section 09 21 16 - Gypsum Board Assemblies: Adjacent wall finish.
.4 Section 09 72 16 - Vinyl-Coated Fabric Wall Coverings: Terminating wall covering at corner guard.

1.3  REFERENCES

.1 CSA-B651-12 - Accessible Design for the Built Environment.

1.4  PERFORMANCE REQUIREMENTS

.1 Corner Guards: Resist lateral impact force of 445 N or 100 lbs at any point without damage or permanent set.

1.5  ADMINISTRATIVE REQUIREMENTS

.1 Section 01 31 00: Project management and coordination procedures.
.2 Coordination:
   .1 Coordinate with other work having a direct bearing on work of this section.
   .2 Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

1.6  SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.
.2 Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements and anchorage details.
.3 Samples: Submit two (2) sections of corner guard, 24 inch long, illustrating component design, configuration, colour and finish.

1.7  SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention.
Part 2 Products

2.1 COMPONENTS

.1 Corner Guard - Surface Mounted:
   .1 Material: Stainless steel.
   .2 Projection From Wall to Outside of Guard: 2”
   .3 Length: One (1) piece. – 4’-0” high.
   .4 Preformed end caps.

.2 Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.2 FABRICATION

.1 Fabricate components with tight joints, corners and seams.
.2 Pre-drill holes for attachment.
.3 Form end trim closure by capping and finishing smooth.

2.3 FINISHES

.1 Corner Guard: Type 304 stainless steel with No. 4 finish

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.
.2 Verify that field measurements are as indicated on Drawings.
.3 Verify that rough-in for components are correctly sized and located.

3.2 INSTALLATION

.1 Install components to manufacturer's written instructions.
.2 Install components level and plumb, secured rigidly in position to wall framing members only.

3.3 SCHEDULES

.1 Refer to Interior Finish Schedule for locations.

END OF SECTION
Part 1 General

1.1 SECTION INCLUDES

.1 Fire extinguishers.
.2 Fire blankets.
.3 Cabinets.
.4 Accessories.

1.2 RELATED SECTIONS

.1 Section 06 10 13 - Wood Blocking And Curbing: Wood blocking and shims.
.2 Section 9 22 16 - Non-structural Metal Stud Framing
.3 Section 09 91 10 - Painting: Field paint finish.
.4 Division 21 – Fire Suppression: Cabinet enclosure for extinguishers and blankets.

1.3 REFERENCES

.2 CAN/ULC-S503-05 (R2010) - Standard for Carbon-Dioxide Fire Extinguishers.
.3 CAN/ULC-S504-12 - Standard for Dry Chemical Fire Extinguishers.
.5 CAN/ULC-S508-02 - Standard for he Rating and Fire Testing of Fire Extinguishers
   (including Amendments 1 and 2).
.6 CAN/ULC-S566-05 - Halocarbon Clean Agent Fire Extinguisher (Includes Amendment
   2, 2012).

1.4 SUBMITTALS FOR REVIEW

.1 Product Data: Provide extinguisher operational features, colour and finish, anchorage
   details.
.2 Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for
   recessed cabinets, wall bracket mounted measurements and locations.

1.5 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements, including special
   criteria and wall opening coordination requirements.
.2 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include test, refill or recharge schedules and re-
   certification requirements.
1.7 QUALITY ASSURANCE
   .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
   .2 Provide units to [AN/ULC-S508]. Maintain one copy of each document on site.

1.8 REGULATORY REQUIREMENTS
   .1 Conform to NFPA 10 for requirements for extinguishers.

1.9 ENVIRONMENTAL REQUIREMENTS
   .1 Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

Part 2 Products

2.1 EXTINGUISHERS
   .1 Refer to Mechanical Specifications and Drawings for Fire Extinguisher Types.

2.2 CABINETS
   .1 Metal: Formed sheet steel, primed; 18 gauge thick base metal.
   .2 Configuration: Surface type, sized to accommodate accessories.
   .3 Door: 18 gauge thick, reinforced for flatness and rigidity; lock with full glass latch access.
   .4 Door Glazing: Glass, clear, 1/8 inch thick tempered float.
   .5 Cabinet Mounting Hardware: Appropriate to cabinet.
   .6 Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
   .7 Pre-drill for anchors.
   .8 Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
   .9 Weld, fill, and grind components smooth.
   .10 Glaze doors with resilient channel gasket glazing.
   .11 Finishing Cabinet Exterior Trim and Door: Anodized, colour as selected.

Part 3 Execution

3.1 EXAMINATION
   .1 Section 01 70 00: Verify existing conditions before starting work.
   .2 Verify rough openings for cabinet are correctly sized and located.
3.2 INSTALLATION

.1 Install to manufacturer's instructions.
.2 Install cabinets plumb and level in wall openings.
.3 Secure rigidly in place.
.4 Place extinguishers and accessories in cabinets.

END OF SECTION
Part 1  General

1.1  SECTION INCLUDES

  .1  Fabrication, finish, hardware, delivery to site and installation of standard furnishings described in Specifications, and as listed below:
    .1  Soft & Task Seating
    .2  Tables & Desks

1.2  REFERENCES

  .1  Applicable Building Code: Accessibility guidelines.

1.3  SUBMITTALS FOR REVIEW

  .1  Shop Drawings: Are required only on non-standard manufacturer’s items or as required by Specifications.
  .2  Samples:
    .1  Submit two (2) samples of each fabric indicating the direction of installation
    .2  Submit two (2) samples of each wood and / or laminate finish.
    .3  Submit two (2) samples of each metal and / or plastic finish.

1.4  SUBMITTALS FOR INFORMATION

  .1  Installation Data: Manufacturer's special installation requirements. Include installation template and attachment devices.
  .2  Maintenance Instructions: Submit two (2) copies of manufacturer’s maintenance instructions including information needed for the removal of common strains from each type of fabric and leather used.

1.5  QUALITY ASSURANCE

  .1  Installation shall be preformed by personnel that have minimum five years of experience installing furniture of comparable quality with ability to install work to meet specified standards.
  .2  Furniture Dealer shall provide an on-site supervisor to direct installation of all furniture items.

1.6  DELIVERY, STORAGE, AND PROTECTION

  .1  Assemble and finish furniture at factory and deliver to site ready for installation
  .2  Protect items during delivery, storage and after installation so that there will be no indication of abuse or damage at the time of substantial completion of the Project. Replace or repair, to showroom condition, damaged work.
.3 Materials damaged due to improper protection during storage (dampness included) shall be rejected and removed from the site.

Part 2  Products

2.1  GENERAL

.1 FURNITURE PRODUCTS LISTED BELOW ARE TO BE ORDERED AND SUPPLIED BY THE OWNER. GENERAL CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION ONLY.

.2 Plan Code. Each item has a designated Plan Code.

.1 TT  Training Table
.2 MT  Meeting Table
.3 WC  Work Chair
.4 TC  Task Chair

.3 Each item within a Plan Code has been assigned a number and or letter for differentiating between individual items.

.1 Example TT1 Training Table 1

.4 Refer to Furniture Plans for furniture locations. Plan Codes will be indicated within.

2.2  FINISHES

.1 Selected manufacturers of finishes and fabrics are those listed within each item appearing in the Furniture Specification.

2.3  WARRANTY

.1 The items specified herein shall be fully and unconditionally guaranteed by the manufacturer against defect in materials, workmanship and installation for the manufacturers standard warranty period after acceptance of installation.

2.4 FURNITURE PRODUCTS LISTED BELOW ARE TO BE ORDERED AND SUPPLIED BY THE OWNER. GENERAL CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION.

2.5  TRAINING TABLE - TT

.1 Manufacturer Teknion; Product: Training Table. CTRT
.2 Rectangular Worksurface: CTRT Size: 30” x 60”
.3 Supports: Slender Fixed Height T-Leg. CTTL. 24” depth x 29” height.
.4 Wire Management: Vertical Wire Management Covers. CTWC. 2 per desk.
.5 Electrical Tray: CTET (S). 1 per table.
.6 Power / Data Center: CLMP. 2 per table. L and R orientation.
.7 Under-Worksurface Plug-in Power Bar: RLPP. One per table.
.8 Keyboard Tray: Undersurface mounted keyboard tray, type: Tiers Adjustable Arm, Option D, space saver, track length 17”.

.9 Laminate: Foundation Laminate, Straight trim Edge. Colour to be selected by Architect from Manufacturer’s standard range.

.10 Quick Release Linking System: CAQR. 4 per table.

.11 Quantity: 24 tables

.12 Other Accessories: General Contractor to supply and install a barrier within the electrical tray to separate the power and communication cables. Refer to Electrical documentation for more information.

2.6 MEETING ROOM TABLE – MT

.1 Manufacturer Teknion; Product: Training Table. CTRT

.2 Rectangular Worksurface: CTRT Size: 30” x 60”

.3 Supports: Slender Fixed Height T-Leg. CTTL. 24” depth x 29” height.

.4 Laminate: Foundation Laminate, Straight trim Edge. Colour to be selected by Architect from Manufacturer’s standard range.

.5 Quick Release Linking System: CAQR. 4 per table.

.6 Quantity: 12 tables

2.7 WORK CHAIR – WC

.1 Manufacturer Steelcase; Product: Leap 462 Series

.2 Frame, Seat Shell, Outer back and five-arm base finish: Black plastic

.3 Fabric Finish: To be selected by Architect from manufacturer’s standard range.

.4 Quantity: 24 Chairs. Owner to confirm if additional chairs required.

2.8 TASK CHAIR – TC

.1 Manufacturer Allsteel; Product: Tolleson Side.

.2 Steel Finish: Black

.3 Fabric Finish: To be selected by Architect from manufacturer’s standard range.

.4 Quantity: 32 chairs. Owner to confirm if additional chairs required.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that site is ready for installation of furniture items.

.2 Coordinate shipping and receiving times with designated Owner’s representative.

3.2 INSTALLATION

.1 Install as per manufacturer instructions.
2. Installation shall be performed by the Contractor or Subcontractor.
3. Contractor shall install furniture in locations shown on plans. Contractor shall reposition or reorient furniture as requested by the Owner.
4. Contractor is responsible for the clean up and removal of all cartons and packaging associated with this furniture.

3.3 FIELD QUALITY CONTROL
.1 Owner or owner representative, shall verify that the installed products match the quality standard established by the sample mock-up (if required) and meet the specification criteria as set forth in the document and by reference in the quality standards.

3.4 ADJUSTMENT & CLEANING
.1 Remove and replace or repair damaged surfaces or defects in finished products to match similar undamaged products.
.2 Remove and replace, or repair damaged wood, finishes or hardware components.
.3 Upon completion of installation, contractor to check for complete function of parts and finish.
.4 Perform final walk-through with inspector, documenting acceptance of furniture, installation and clean up.

3.5 SCHEDULES
.1 Training Tables - TT. To be located in the Training Room and Test lab.
.2 Meeting Tables – MT. To be located in Meeting Rooms C0312 & C0313.
.3 Work Chair – WC. To be located in the Training Room and Test lab.
.4 Task Chair – TC. To be located in Meeting Rooms C0312 & C0313.

END OF SECTION
1.0 GENERAL

1.1 Intent

1.1.1 Work in Divisions 20, 21, 22 and 23 will include all drawings and all sections of the specifications that form the Contract Documents, including all addenda, and including IFB 1746KF, whether defined in Divisions 20, 21, 22, and 23 or elsewhere, or whether defined in mechanical drawings or elsewhere.

1.1.2 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances. Include all costs to obtain all permits and to pay for all fees and charges, including inspection charges by the authorities that issue the permits; coordinate all related inspections.

1.1.3 Contract documents of the Specifications and Drawings, are generally diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

1.1.4 Review Contract Documents and notify the Owner of issues of conflict that require clarification prior to submitting tender. Failure by the Contractor to secure clarification does not relieve the Contractor to comply with the intent of the design and/or the Contract Document.

1.1.5 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents. Provide adequate access space for maintenance and service, and clearances required by code and by the Authority.

1.1.6 Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Engineer.

1.1.7 Unless specified otherwise, the Owner shall be responsible for routine maintenance defined by the manufacturer's instructions during the warranty period. The Owner will be responsible for supplying replaceable components such as filters during the warranty period.

1.1.8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, assemble, move in place and install complete; start-up and test.

1.1.9 Do not block existing facilities such as PT cable access ports, conduit and junction boxes, fire dampers or fire and life safety equipment.
.10 Mechanical Contractor shall keep one (1) complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions which deviate from the original contract documents. Engineer to transfer Red Pencil as-built to AutoCAD.

1.2 Related Requirements

.1 General Requirements IFB 1746KF
.2 Submittals IFB 1746KF
.3 Execution and Closeout Requirements IFB 1746KF
.4 Warranty IFB 1746KF

1.3 Related Work Specified In Other Sections

.1 Bidding Requirements and General Conditions of Contract IFB 1746KF

1.4 Codes, Regulations, Permits, Fees And Inspections

.1 Conform to the latest edition and supplements of the following for all materials and installations:

.1 Alberta Building Code, as amended by local bylaws and Provincial Statutes.
.2 National Energy Code.
.3 National Fire Protection Association.
.4 Codes, Standards, Bylaws, Statutes and Manufacturer’s Association Specifications or instructions mentioned in Divisions 20 and 23 sections, refer to latest revisions thereof at time of calling of bids, unless specifically designated otherwise.
.5 In no instance shall the standard established by the drawings and specifications be reduced by code or otherwise.
.6 Where conflict or discrepancies between Codes, Standards, Bylaws, Statutes, Specifications, Drawings, etc., exist, the most stringent requirement to apply.
.7 Furnish all notices, obtain all necessary permits related to Divisions 20 and 23 work.
1.5 Installation Requirements

.1 Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Engineer. Field verify all dimensions, clearances, maintenance clearances, equipment handing requirements, invert elevations, and other similar measurements prior to any fabrication and installation. Notify the Engineer of any discrepancies that require resolution.

.2 Install ductwork only in concealed spaces, unless otherwise approved.

.3 Remove and replace improperly installed mechanical work, or work that requires modifications due to coordination issues or conflicts.

1.6 Provisions For Maintenance

.1 Install maintainable components such as VAV, valves, and dampers in a manner to facilitate proper access for maintenance.

.2 Allow minimum clearance in front of electrical components, such as motor, starters, and control panels in accordance with applicable codes.

1.7 Warranty

.1 Comply with warranty requirements defined in Division 01.

.2 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial performance of work. The Contractor shall repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.

1.8 Owner Requirements During Warranty

.1 Unless specified otherwise the Owner shall be responsible for all routine maintenance requirements as required in the manufacturer's instructions.

.2 The Owner shall be responsible for supplying filters, grease and belts.
1.9 Materials

.1 Materials and equipment installed shall be new, full weight and of quality specified. Use same brand or manufacturer and model for each specific application.

.2 Each major component of equipment shall bear manufacturer’s name, address, catalog and serial number in a conspicuous place.

.3 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Engineer and at no cost to the Owner.

.4 Install materials and equipment in a quality manner providing good workmanship by competent tradesmen.

1.10 Availability Of Equipment And Materials

.1 Make known in writing to the Engineer five (5) days prior to the tender closing date any materials specified that are required to complete the work which are not locally supplied, or are not currently available or will not be available for use as called for herein. Failing to do so, it will be interpreted that the most expensive alternate has been included in the tender price.

1.11 Alternate Materials And Equipment

.1 Comply with requirements in Division 01.

.2 The price submitted for this contract shall be based on the use of materials and equipment as specified.

.3 The Contractor shall be fully responsible for all costs for work or materials required by the trades or other contractors to accommodate use of other than specified materials or equipment including redesign costs.

1.12 Drawings And Specifications

.1 The responsibility and scope of each sub-trade rests solely with the General Contractor. Extras will not be considered based on the grounds of difference in interpretation of specifications as to which trade involved is to provide certain specifications or materials.

.2 Drawings and specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both.

.3 Should any discrepancy appear between drawings and specifications which leaves the Contractor in doubt as to the true intent and meaning of the plans and specifications, obtain a ruling from the Engineer in writing or by Addendum, before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been included.

.4 Where errors or discrepancies appear in catalogue numbers, provide the material in accordance with the system requirements and to the standard of the specifications.
.5 Prior to construction start, examine all contract documents, including all drawings and specifications, and work of other trades to ensure that work can be satisfactorily carried out without changes to building.

.6 The scope of work in this division shall include all work defined in the Contract Documents, including work which may exceed the minimum requirements of codes and standards that are referenced in the Contract Documents.

1.13 Examination Of Site

.1 Before submitting tender, visit and examine the site and note all characteristics and features affecting the work. Report discrepancies to the Engineer five (5) days prior to tender closing. No allowances will be made for any difficulties encountered or any expenses incurred because of any conditions of the site or item existing, thereon, which are visible or known to exist at the time of tender. Failure to advise Engineer of discrepancies will assume contractor accepts documents as presented without potential of additional costs.

1.14 Coordination Of Work

.1 Cooperate and coordinate with other trades on the project. Phase work in sequence with the General Contractor.

.2 Coordinate with the Contractor and Electrical Trade all requirements for electrical services to mechanical components and equipment.

.3 Using shop drawing data, prepare a comprehensive list to define all specific electrical requirements needed by the Division 23 work to complete the installation. Coordinate with Electrical Trade.

.4 Prepare and submit drawings to the Contractor and structural engineer defining mechanical system support loads and support details. Include definition of pipe and/or loads on structural elements and anchor arrangements.

1.15 Cutting And Patching

.1 Provide inserts, holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

.2 Provide inserts or drill for expansion bolts, hanger rods, brackets, and supports.

.3 Obtain written approval from Owner before drilling, coring, cutting or burning structural members.

.4 Patch and make good building where damaged from equipment installation, damage to ceiling tiles and T-bar, etc. Work to be performed by the trade or contractor responsible for the type of work.
1.16 Certificate Of Substantial Performance

.1 In addition to the requirements of IFB 1746KF, and prior to application for a "Certificate of Substantial Performance" of the work, the contractor shall certify the following in writing to the Engineer:

.1 All ducted supply/return grilles are installed.
.2 All new supply air and return air is installed and cleaned.
.3 All thermal and acoustic insulation is installed.
.4 All access doors are suitably located, and equipment easily accessible.
.5 All equipment is checked for operation.
.6 Air system balance is completed and the reports have been submitted for review.
.7 All equipment is lubricated as per manufacturer's data.
.8 All terminal air boxes are identified and numbered, and all equipment identified.
.9 All necessary tests and start-up procedures on equipment have been made, including those required by authorities.
.10 The building automation system seven (7) day acceptance test has been successfully completed.
.11 Documentation required by the following sections has been submitted:

.1 General Documentation Section 20 05 05

.12 Following information has been submitted:

.1 Mechanical Contractor shall certify (by sign-off) that each deficiency listed in all inspection reports has been corrected, or defined as a seasonal deficiency with a cost allowance.
.2 Final draft of O&M Manuals.
.3 Final certificates from authorities having jurisdiction.
.4 System cleaning reports.
.5 Reports from manufacturer on noise and vibration control devices.
.6 Completed record drawings.
.7 Vendor's equipment start-up reports in related sections and as required in Section 20 05 05 - General Documentation.

.2 Identify any systems which cannot be installed and/or placed in operation for reasons beyond the normal control of the contractors and submit a statement of the value of the remaining work required to complete the project.
.3 Within ten (10) days of receipt of a written application for a "Certificate of Substantial Performance", the Engineer shall visit the site to confirm that all requirements listed in Article 1.16.1 are complete. Mechanical Contractor shall attend this site review and provide a copy of the O&M Manual.

.4 If, after the Engineer's site visit the application for a "Certificate of Substantial Performance" is not approved, the contractor shall reapply in accordance with the Engineer's site visit report and pay for costs of re-inspection services.

1.17 Certificate Of Total Performance

.1 Comply with the requirements of IFB 1746KF.

.2 Prior to application for a statement of "Total Performance", the Contractor shall certify the following in writing to the Engineer:

  .1 All items noted in previous site visit reports including that performed for Substantial Performance have been completed.
  .2 All controls have been calibrated and set.
  .3 Warranty forms are mailed to manufacturer. (Provide copy of original warranty for equipment which has a warranty period of longer than one (1) year).
  .4 Completed and accepted Operating and Maintenance (O&M) Manuals have been submitted to Owner.
  .5 Completed and accepted final Air Balancing Reports have been included in the O&M Manuals.

.3 Within ten (10) days after receipt of a written application for a "Certificate of Total Performance", the Engineer shall visit the site.

.4 The Engineer shall provide one (1) visit for the purpose of reviewing the application for a "Certificate of Total Performance". Subsequent visit if required, shall be at the expense of the contractor.

1.18 Shop Drawings

.1 Submit shop drawings in electronic (PDF) format, complete with appropriate cover sheets, transmittals and stamps.

.2 Prior to submission to the Engineer, the Contractor shall review all shop drawings. By this review, the Contractor certifies that he has determined and verified the following:

  .1 Measurements are verified with field installation space requirements.
  .2 "Handling" of equipment for access and maintenance is correct.
  .3 Access for maintenance requirements is defined.
  .4 Field connections for wiring, controls, piping and ductwork connections are defined.
  .5 Electrical service connections and characteristics are defined.
  .6 Work required by other trades is defined.
.7 Vendor’s catalogue numbers are correct and consistent with the system performance criteria.
.8 Shop drawings meet all requirements of the contract documents.

.3 The Contractor’s review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.

.4 Identify materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Engineers office. Maintenance and operating manuals are not suitable submittal material. Where equipment is identified by name or number on the drawings or specification, clearly mark each shop drawing with the identical name and/or number.

.5 Clearly mark each sheet of submittal material (using arrows, underlining, or circling) to show differences from what is specified, particularly sizes, types, model numbers, rating, capacities, and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.

.6 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, service connection data and motor sizes.

.7 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Engineer.

.8 The shop drawing review by the Engineer will provide the following certification: "Review by WSP is for general conformance with the design intent and general compliance with the contract documents. Contractor is responsible for all dimensions, suitability with site conditions, quantities and compliance with contract documents, coordination of work with all other trades and performing all work in a safe and satisfactory manner."

1.19 Equipment Protection And Clean-Up

.1 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Thoroughly clean ducts and equipment of dirt, cuttings and other foreign substances.

.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.5 Ensure that existing equipment to be turned over to the Owner or reused is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.
1.20 Temporary Or Trial Usage

.1 Temporary or trial usage requested by the Owner of mechanical equipment supplied under contract shall not represent acceptance. Operate and maintain all equipment and systems during trial usage.

.2 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Operating and Maintenance Manuals.

.3 Record Drawings.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Requirements IFB 1746KF
   .2 General Mechanical Provisions Section 20 05 01

   .2 Heating, Ventilation and Air Conditioning Division 23

1.3 Quality Assurance

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

2.0 PRODUCTS

2.1 Operation and Maintenance Manuals

.1 Refer to IFB 1746KF.

.2 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

2.2 Electronic Copy

.1 Provide one (1) electronic copy on USB flash drive (with 8 GB minimum capacity).

.2 Provide one (1) electronic copy of operation and maintenance manual.

2.3 Binders

.1 Binders are not required. WCB has existing. New inserts for this work are required.
2.4 Tabs

.1 Tabs not required, only documents that fall under the following tabs already existing as per Section 20 05 05, 2.5, three (3) hard copies required.

- Air Systems
- Control Systems
- Cooling Systems
- Heating Systems
- Plumbing Systems

2.5 Manual Divisions

.1 Organize each manual into the following divisions.

.1 Operation Division
.2 Maintenance Division
.3 Contract Documentation Division

2.6 Operations Division

.1 The operations division shall have all data organized into sections according to the system category with individual divider tabs as follows:

.1 AIR - Air Systems
.2 CTL - Control Systems
.3 CLG - Cooling Systems
.4 HTG - Heating Systems
.5 PLG - Plumbing Systems

.2 Organize data for each system category (section) into individual sub-systems. Provide an index for each system category and a divider tab for each individual system.

.3 For each individual sub-system include the following:

.1 System Description - Provide details of system type, composition, areas served, location in the building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description.

.2 System Schematics

.1 Provide individual system schematics for each system.
.2 Include mechanical equipment and component identification using BCMS system mnemonic, as well as design designation.
.3 Use these specific naming conventions on all references through the O&M Manual.
Operating Instructions - Provide, in "operator" layman language, the specific instructions for start-up, shutdown and seasonal changeover of each system component. Include exact type and specific location of each switch and device to be used in the system operation. Identify safety devices and interlocks that must be satisfied in order for the equipment to start. Also, list conditions to be fulfilled before attempting equipment start-up, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, filters/strainers in place, etc.

Maintenance Division

Organize data into the following sections with divider tabs:

1. Maintenance Tasks And Schedules
2. Spare Parts
3. Suppliers And Contractors
4. Tags And Directories

Maintenance Tasks and Schedules - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturer's maintenance brochures, for each component of each system in the following format:

1. Daily
2. Weekly
3. Monthly
4. Semiannually
5. Annually
6. When Required.

Spare Part List - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize from manufacturers maintenance brochures the recommended spare parts for each component of each system.

Suppliers and Contractor List - Provide summary of Suppliers and Contractors for each components of each system. List name, address and telephone number of each.

Tags and Directories - Provide a copy of the Mechanical Drawing, List, Valve Tag List, Piping Identification Schedule and all other directories as specified in the contract documents.
.5 Contract Documentation Division

.1 Organize all data required by the construction contract into sections, with divider tabs, as follows:

.1 Drawings List
.2 Shop Drawings and Product Data
.3 Certifications
.4 Warranties and Bonds
.5 Maintenance Brochures
.6 Reports

.2 Shop Drawings and Product Data - Provide final copies of all shop drawings and product data required by the contract documents. Include section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system shop drawing per tab.

.3 Certifications - Provide copies of Contractor Certifications for the performance of product and systems. Include copies of all pressure tests for piping and ductwork systems, equipment alignment certificates, local authority inspection reviews, backflow prevention certification, and fire protection certifications. Include section index and divider tabs with maximum of twenty-five sheets (25) or one (1) report per tab.

.4 Warranties and Bonds - Include one (1) copy each of the Contractor's, warranty, manufacturers' warranties longer than one (1) year, the bond, and any service contract provided by the contractor. Provided section index.

.5 Maintenance Brochures - Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. Provide section index and divider tabs. Maximum of twenty-five (25) sheets or one system brochure per tab.

.6 Reports - Include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, water treatment reports and manufacturer's start-up reports, as required by the contract specification sections.
.6 Submissions and Approvals

.1 First Draft Submission

.1 Contractor shall submit a draft copy of the operations and maintenance manuals for format review at the 75% construction completion stage.

.2 The draft submission is to be bound in 3 ring loose leaf type binders and shall include the following information:

.1 A table of contents for the complete manual.
.2 Index of each division of the manual.
.3 Index of each section of the operations and maintenance divisions.
.4 A sample operations division write-up for a typical system, including sample schematic.
.5 A sample maintenance division write-up for the same typical system.
.6 Sample proof of binder covers and spines.

.3 On completion of review of the first draft submission the consultant will return the copy of the manual with review comments for resubmission.

.2 Final Edition

.1 Prior to final acceptance the contractor shall submit three (3) copies of the final edition of the manual and one electronic copy.

.2 This final edition shall include all outstanding project information and conform to all requirements listed in this document.

2.7 Record Drawings

.1 Refer to and comply with Section 20 05 01 - General Mechanical Provisions.

.2 The contractor shall keep, on-site, available to the Engineer at all times and particularly for each regularly scheduled site meeting, a complete set of prints, edge bound, that are to be updated daily showing any and all deviations and changes from the Contract Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.

.3 Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.
3.0 EXECUTION

3.1 General

.1 Submit documents to the Engineer for approval prior to transmitting to the Owner.

END OF SECTION
1.0 GENERAL

1.1 Scope

1.1.1 Demonstration of equipment and systems operations.

1.1.2 Instruction and seminars for Owner’s personnel.

1.2 Related Work Specified in Other Sections

1.2.1 Refer to and comply with the following sections:

1.2.1.1 Contract Closeout Section 01 70 00

1.2.1.2 Demonstration and Training Section 01 79 00

1.2.1.3 General Mechanical Provisions Section 20 05 01

1.2.1.4 Equipment Testing and Start-Up Section 20 05 08

1.2.1.5 Controls Section 20 30 Series

1.2.2 Fire Suppression Division 21

1.2.3 Plumbing Division 22

1.2.4 Heating, Ventilation and Air Conditioning Division 23

1.3 Quality Assurance

1.3.1 Work specified shall be performed by the Contractor and his Subtrades and Suppliers.

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION

3.1 General

3.1.1 Arrange for presentation and demonstration of mechanical equipment and systems by appropriate specialists and shall ensure that required manufacturer’s representatives are in attendance.

3.1.2 Coordinate demonstration and instruction agenda and schedule with the Owner and Engineer.

3.1.3 Coordinate demonstration and instruction agenda and schedule for work performed outside the contract with the Owner and Engineer.

3.1.4 Provide personnel when necessary to ensure proper detailed training is provided for all mechanical systems.
3.2 Demonstrations

.1 Demonstrate specific starting and stopping and general maintenance requirements for each major piece of equipment. Ensure all labeling and identification is completed.

.2 Demonstrate the following systems, in the form of instruction seminars and contractor-guided tour of the facility.

  .1 Hydronic Heating Systems
  .2 Air Systems
  .3 Fire Protection Systems
  .4 Plumbing Systems
  .5 Control Systems
  .6 Balancing

.3 Demonstrate the following pieces of equipment and systems to the Owner and to the Authority Having Jurisdiction.

  .1 Fan Coil Units/Condensing Unit
  .2 Terminal Air Units
  .3 Condensate Pump

.4 Refer to sample mechanical system agenda schedules in Item 3.3 following for identifying the proposed sequence of demonstrations. Sequence of demonstration and duration of training seminars to suit project. Submit agenda for review by Engineer one month prior to demonstration.

.5 Answer all questions raised by Owner at demonstrations; if unable to satisfactorily answer questions immediately, provide written response within three (3) days.

.6 Provide sign off sheets for each session. Sign off sheets to have attendees, date, subject, presentation by and comments. Attach the sign off sheets to the agenda and submit a copy to the engineer following training seminars.
3.3 Mechanical Systems Agenda (sample)

**Mechanical Systems Agenda**

**Topic:** Heating, Cooling, Controls, and Ventilation Systems

**Day:**

<table>
<thead>
<tr>
<th>Start Time</th>
<th>Meeting Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am</td>
<td></td>
</tr>
</tbody>
</table>

**Approximate Duration:** 3 hours

**Agenda:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am</td>
<td>Classroom Presentation</td>
</tr>
<tr>
<td>9:00 pm</td>
<td>Site Walkthrough</td>
</tr>
<tr>
<td>10:00 pm</td>
<td>Final Questions and Sign-off Log Sheet</td>
</tr>
</tbody>
</table>

**Personnel to be in Attendance:**

1. Mechanical Contractor and Sub-Contractors (as required)
2. Maintenance staff

**Presentation Format:**

**Classroom:**

**Introduction**

1. Pass out handouts of system description
2. Reference to equipment operation brochures as required.
3. Detailed system overview by Mechanical Contractor, Sub-Contractors and Suppliers
4. Review of system installations by the Mech. Contractors using record drawings

**Site Tour:**

1. Mechanical Contractor to outline location of main piping runs, isolation valves, service access points.
2. Review service procedures for direct expansion fan coil units/condensing units.
3. Terminal hot water heating units to be reviewed for service and operation.
4. Provide written instructions on how to start and stop all equipment and demonstrate using instructions during tour.

**END OF SECTION**
1.0 GENERAL

1.1 Scope

.1 Test low velocity ducts.
.2 Test medium velocity ducts.
.3 Test heating water piping.
.4 Test sprinkler system piping.
.5 Test control air piping.
.6 Test condensate piping.
.7 Test refrigerant piping

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05

.2 Testing, Balancing and Adjusting Section 20 22 00
.3 Controls Section 20 30 33
.4 Heating, Ventilation and Air Conditioning Division 23

1.3 Quality Assurances

.1 Test equipment and material where required by specification or authority having jurisdiction to demonstrate its proper and safe operation.

.2 Test procedures in accordance with applicable portions of ASME, ASHRAE, SMACNA, N.F.P.A. and other recognized test codes.

.3 Perform tests on site to the satisfaction of the Engineer.

.4 Piping, fixtures or equipment shall not be concealed or covered until installation is inspected and approved by the Engineer. Provide written notice to the Engineer at least three (3) days in advance of tests or concealing of piping.

.5 Coordinate with engineer at start of the project, those tests that will require witnessing by the Engineer.

.6 Submit sample test certificate forms for review two (2) weeks prior to any testing on site.
1.4 Submittals

.1 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

.2 Perform tests as specified. Include test certificates in Operating and Maintenance Manuals.

1.5 Liability

.1 Take charge of plant during tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration in this connection.

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION

3.1 Pressure Tests

.1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy and date of calibration. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.

.2 Carry out tests for eight (8) hour period and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re-witnessing.

.3 Closed Loop Piping Systems: Test to 1-1/2 times maximum working pressure or 150 psi, whichever is greater, water pressure measured at system low point.

.4 Drainage systems: Test by filling with water to produce water pressure to 4.5 psi minimum and 9 psi maximum.

.5 Water piping: Test to 1-1/2 times maximum working pressure or 150 psi, whichever is greater, water pressure measured at system low point.

.6 Sprinkler System: Test as required by current edition of NFPA 13 and authorities having jurisdiction.

.7 Refrigerant Piping: Test with nitrogen to 300 psi on high pressure side and 150 psi on low side and refrigerant halide torch test.

.8 Ducts: Check for audible leaks at 2" WG above associated fan external static pressure.

.9 Low pressure ducts: Check for audible leaks at operating pressures.
.10 Medium Pressure Ductwork: Check for audible leaks. Test for tightness as specified by the SMACNA Manuals with maximum leakage of 1/2% at any branch or main duct at 12" WG static pressure for round ductwork and 8" WG static pressure for rectangular ductwork.

.11 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air.

.12 During heating piping system tests, check linear expansion at elbows, U bends, expansion joints and offsets for proper clearance.

.13 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubbler test for air or nitrogen test medium and halide torch for refrigerant medium.

.14 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Performance testing of equipment.

.2 Manufacturer's start-up of equipment.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1</td>
<td>General Requirements IFB 1746KF</td>
</tr>
<tr>
<td>.2</td>
<td>General Mechanical Provisions Section 20 05 01</td>
</tr>
<tr>
<td>.3</td>
<td>General Documentation Section 20 05 05</td>
</tr>
</tbody>
</table>

1.3 Quality Assurance

.1 Use factory trained representatives and submit manufacturer's check sheets for starting all systems and equipment.

.2 Prior to starting, testing, balancing, adjusting, and cleaning processes, verify with Engineer any tests required to be witnessed. Provide sufficient notice to Engineer prior to commencement of procedures.

.3 Engineer shall be allowed to witness any testing, adjusting, starting, balancing, and cleaning procedures.

.4 Assume all costs associated with starting and testing, including the supply of testing or cleaning medium.

.5 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.

.6 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.7 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.

.8 Some processes involved in starting procedures defined in this section may be duplications of authorities' verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.9 All starting, testing, and procedures shall be in accordance with applicable portions of ASME, ASHRAE, AABC, CSA, NFPA, SMACNA, ASTM, ASPE and as required and outlined in these specifications. In particular note the testing requirements of NFPA-20 fire pumps, and of the authorities having jurisdiction.
.10 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the readings and tests.

.11 Assume all liabilities associated with starting, testing and balancing procedures.

1.4 Related Work Specified In Other Sections

.1 General Documentation

Section 20 05 05

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION

3.1 General

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Meet with Division 26 manufacturers, suppliers, and/or other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.3 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.

.4 Confirm voltages and operating amperages at full load.

.5 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor’s expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.
3.2 Procedures

.1 Procedure shall be identified in the following five (5) distinct phases:

.1 Pre-Starting: Visual inspection.
.2 Starting: Actual starting procedure.
.3 Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.
.4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.
.5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.

.2 Check specified and shop drawing data against installed data.

.3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

3.3 Contractor Testing Responsibilities

.1 The contractor shall be required to provide the following tests as part of his construction contract. For each test, a test form is to be filled out, witnessed, kept on site for the consultant to verify at any time during construction and then they are to be included in the final submission of the contractor O&M manuals.

.1 Air Systems

.1 Terminal Boxes

.1 Measure air flow and inlet static pressure
.2 Verify box installation duct inlet
.3 Measure discharge sound power level at 10'-0" downstream
.4 Verify box control volume read outs by traverse
.5 Measure box temperature profile
.6 Verify box access acceptability

.2 Air Outlets

.1 Take sound readings at specified air flows at outlets

.3 Fire Dampers

.1 Test each damper to ensure proper blade movement and damper closure
.2 Verify damper accessibility for changing of the fusible links
.4 Ductwork

.1 Low pressure supply, return and exhaust ductwork is to be tested by sound and feel for leakage.

.2 Medium and High pressure supply, return and exhaust ductwork is to be pressure tested as per requirements of Section 23 05 07.

.5 Direct Expansion Fan Coil Unit and Condensing Unit

.1 Check unit is level

.2 Measure air flow and static pressure

.3 Entering dry bulb/wet bulb temp.

.4 Leaving dry bulb/wet bulb temp.

.5 Acoustic measurements

.6 Manufacturer check sheets for starting equipment

.2 Fire Protection System

.1 Sprinkler Systems

.1 Test sprinkler system as per NFPA 13.

.2 Fire Extinguishers

.1 Check that no pressure drop occurs over a twenty (20) day period.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Gate valves.
.2 Balancing Valves
.3 Globe or angle valves.
.4 Check valves.
.5 Ball Valves
.6 Drain valves.
.7 Hose bibbs.
.8 Strainers.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05

.2 Pipe and Pipe Fittings Section 20 20 30

.3 Plumbing Division 22

.4 Heating, Ventilation and Air Conditioning Division 23

1.3 Manufacturer

.1 Provide valves of the same type by the same manufacturer throughout.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

.3 All valves shall meet the requirements of the Manufacturers Standardization Society, Standard Practice standards, latest edition. SP-67 Butterfly Valves, SP-70 Cast Iron Gate Valves, SP-71 Cast Iron Check Valves, SP-80 Bronze Gate, Globe, Angle and Check Valves and SP-82 for pressure testing.

.4 Ball valves to be ULC listed, SP. 110 Standard.

1.4 Shop Drawings

.1 Submit copies of valves "ordering schedule" for review before ordering valves.

.2 Submit detailed shop drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.
VALVES AND STRAINERS

November 2017

2.0 PRODUCTS

2.1 Acceptable Manufacturers

.1 Gate Valves : Jenkins, Crane, Toyo, Kitz.

.2 Globe Valves : Jenkins, Crane, Toyo, Kitz.

.3 Angle Valves : Jenkins, Crane, Toyo, Kitz.

.4 Swing Check Valves : Jenkins, Crane, Toyo, Kitz, Mueller SPX, Moygro, Victaulic.

.5 Ball Valves : Jenkins, Crane, Toyo, Kitz, MAS, Apollo.

.6 Drain Valves : Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.

.7 Hose Bibbs : Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.

.8 Radiator Valves : Dahl, Crane, Jenkins, Toyo, Kitz.

.9 Circuit Balancing Valves : Tour and Anderson, Armstrong.

.10 Strainers : Jenkins, Crane, Toyo, Kitz, Victaulic, Mueller SPX.

2.2 Hot Water Heating Systems

.1 Ball Valves up to 50 mm: Two piece bronze body, full standard port, chrome plated, solid bronze ball, threaded ends or solder ends, TFE seat and packing, lever handle, rating 4134 kPa non-shock W.O.G. rating. Jenkins Figure 910J, Toyo #5044A, Toyo #5049A, Kitz #58, Kitz #59.

.2 Swing Check Valves up to 50 mm: Bronze body and disc, regrinding swing check, screw-in cap, threaded ends, rating 860 kPa steam. Jenkins Figure 4092J, Toyo #236, Kitz #22.

Swing Check Valves 65 mm and Over: Cast iron body, regrind-renew swing check, bolted cover, flanged or grooved ends, bronze disc and seat ring, rating 860 kPa steam. Victaulic #716, Jenkins Figure 587J, Toyo #435, Kitz #76, Moyes & Groves W12A-I6V, Centerline Series 800.

.3 Silent Check Valve for Pump Discharge:

Up to 50 mm: Bronze body, SS stem, 316 SS spring, Teflon disc and seat ring, 430 SS seat screw, threaded ends. 1380 kPa water. Val Matic Series VM-S1400.

50 mm and Over: Wafer style, cast iron body, 316 SS seat, plug, spring and bushing. ANSI Class 125. Victaulic #716, Val Matic Series 1400, Moyes Groves W12A-I6A, Centerline Series 800.
.4 Terminal Heat Transfer Unit Valves up to 30 mm: Heavy pattern brass body radiator valve, wheel handle, rising stem, inside screw, renewable composition swivel disc, straight or angle globe, threaded or union ends, positive back seating. Dahl Series 11040, Hammond #100, #200, #8421-9, Toyo #252/253.

Terminal Heat Transfer Unit Valves 40 mm and Over: Bronze gate valves, threaded ends up to 50 mm, cast iron gate valves, flanged ends, valve sizes 65 mm and over. Jenkins Figure 810J, Figure 454J, Toyo #293, Kitz #24.

.5 Terminal Heat Transfer Unit Balancing Valves up to 30 mm: Removable cap key, screw set memory bonnet for balancing, brass body, rising stem, inside screw, renewable composition swivel disc, straight or angle globe, threaded or union ends, positive back seating. Dahl Series 13000-M, Toyo #250/#251.

Terminal Heat Transfer Unit Balancing Valves 40 mm and Over: Eccentric plug valve, as described above.

.6 Drain Valves up to 50 mm: Forged brass body, brass cap, stem, and ball. Teflon stem seals and Teflon seat. Hose thread end. Working pressure 1725 kPa at 121°C. Dahl 50.430, Jenkins Fig 901CJ, Toyo #5046, Kitz #68AC.

Drain Valves 65 mm and Over: Bronze body, bronze ball, threaded ends, twin seal Teflon seats and Viton seals, "O" ring, lever handle, rating 2070 kPa at 121°C water. Jenkins Figure 32BJ.

Terminal unit brass T-body drain valve, wheel handle, ground body-bonnet joint, renewable disc, brass chain, forged brass gasketed cap. Working pressure 1725 kPa at 121°C. Dahl 21.616.


3.0 EXECUTION

3.1 Installation

.1 Install valves with stem upright or horizontal, not inverted.

.2 Install valves for shut-off and isolating service, to isolate all equipment, parts of systems, or vertical risers.

.3 Where permitted by codes, butterfly valves may be used in fire protection systems.

.4 Install globe or angle valves for throttling service and control device or meter bypass.

.5 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.

.6 Size drain lines and drain valves equal to size of apparatus drain connection.
.7 For pipe sizes 20 mm and over, minimum drain size to be 20 mm.

.8 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.

.9 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.

3.2 Application

.1 Provide valves as indicated on the drawings and as outlined in the following schedule:

.1 Globe and Angle Globe Valves
   .1 Throttling service
   .2 Control device

.2 Drain Valve
   .1 Near main shut-off valves
   .2 Low points in piping systems
   .3 Bases of vertical risers
   .4 At equipment

.3 Ball Valves
   .1 Shut-off and isolation
   .2 Isolating service
   .3 Domestic water (hot and cold)
   .4 Heating system water
   .5 Glycol system
   .6 Drain valves

.4 Circuit Balancing Valves
   .1 On piping systems where shown on drawings
   .2 On domestic hot water recirculation systems
   .3 On radiant panels for flow balancing.

.5 Radiation Valves and Ball Valves
   .1 Heating/cooling coils
   .2 Isolation of unit heaters and force flows
   .3 Isolation of radiant panels.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Pipe hangers and supports.
.2 Duct hangers and supports.
.3 Sleeving for mechanical equipment.
.4 Pipe anchors.
.5 Access Doors (in walls and ceilings).
.6 Pipe and duct penetrations through fire rated walls and floors.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05
.2 Heating, Ventilation and Air Conditioning Division 23

1.3 Reference Standards

.1 Pipe supports shall meet the requirements of ANSI B31.1 Power Piping.
.2 Duct hangers shall conform to SMACNA Duct Manuals.

1.4 Submittals

.1 Comply with requirements of Section 20 05 05 - General Documentation.
.2 Submit shop drawings of each factory fabricated component.

2.0 PRODUCTS

2.1 Inserts

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.
.2 Size inserts to suit threaded hanger rods.
.3 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
.4 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 4" or ducts over 60" wide.

.5 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.6 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed (4" minimum) square steel plate and nut above slab.

2.2 Pipe Hangers and Supports

.1 Hangers, Pipe Sizes ½" to 1½": Adjustable galvanized steel clevis.

.2 Hangers, Pipe Sizes 2" and Over: Adjustable wrought steel clevis.

.3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Cast iron roll and stand for hot pipe sizes 6" and over.

.4 Wall Support, Pipe Sizes to 3": Cast iron hook.

.5 Wall Support, Pipe Sizes 4" and Over: Welded steel bracket and wrought steel clamp.

.6 Vertical Support: Steel riser clamp.

.7 Floor Support, Hot Pipe Sizes 5" and Over: Adjustable cast iron roll and stand, steel screws and concrete pier to steel support.

.8 Design hangers so they cannot become disengaged by movements of supported pipe.

.9 Provide copper plated hangers and supports for copper piping.

.10 Provide galvanized hangers and supports for galvanized piping.

2.3 Hanger Rods

.1 Provide galvanized rods, threaded both ends, threaded one end, or continuous threaded.

2.4 Duct Hangers and Supports

.1 As a minimum, conform to Standards in SMACNA.
2.5 **Sleeves**

.1 Pipes through Floors: Form with steel pipe or XFR PVC sleeves.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe.

.3 Ducts: Form with galvanized steel.

.4 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.6 **Access Doors**

.1 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be UL-listed. Refer to Architectural plans for fire rated ceilings and walls.

.2 Acceptable Manufacturers and Products: Acudor; Miami Carey; Micor; Titus; Controlled Air; Mifab.

.3 Minimum 300 mm x 300 mm for inspection and hand access. Minimum 450 mm x 450 mm for personnel access.

2.7 **Fire Stops**

.1 Rated caulking for pipe penetration through fire rated floors and walls:

.1 Acceptable Manufacturers: Hilti; 3M.

.2 Sealant shall be thioxtrepic, infumescent, non-slump, non-volatile.

.3 Firestop material shall provide a 2h rating and be in compliance with ASTM-E814, UL1479, ASTM-E119, UL723, ASTM-E84, UL263 and CAN4-5115.

.2 Rated fire stop for PVC and CPVC plastic pipe:

.1 Acceptable Manufacturers: 3M; Hilti.

.2 Infumescent collars, suitable for use on PVC or CPVC pipes penetrating 1h or 2h rated wall or floor, tested to CAN4-S115, UL Listed.
3.0 EXECUTION

3.1 General Requirements

.1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with manufacturer’s recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building structure or inserts in concrete construction.

.5 Provide and set sleeves or block-outs required for equipment, including openings required for placing equipment.

.6 Do not weld piping, ductwork or equipment supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the Structural Engineer.

.7 Obtain approval prior to drilling for inserts and supports for ductwork system. Discuss and obtain approval for hanging systems and methods with Structural Engineer.

.8 Obtain approval prior to using percussion type fastenings.

.9 Use of ductwork, piping or equipment for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.

.10 Install rubber vibration isolators on piping supports within drywall partitions.

3.2 Pipe Hangers and Supports

.1 Support horizontal steel and copper piping as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size in</th>
<th>Distance Between Supports in Steel</th>
<th>Distance Between Supports in Copper</th>
<th>Hanger Rod Diameter in</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; to ¾&quot;</td>
<td>72&quot;</td>
<td>60&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>1&quot; to 1½&quot;</td>
<td>84&quot;</td>
<td>72&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2&quot; to 2½&quot;</td>
<td>120&quot;</td>
<td>96&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>3&quot; to 4&quot;</td>
<td>144&quot;</td>
<td>120&quot;</td>
<td>½&quot;</td>
</tr>
<tr>
<td>6&quot; to 12&quot;</td>
<td>168&quot;</td>
<td>160&quot;</td>
<td>¾&quot;</td>
</tr>
<tr>
<td>14&quot; to 18&quot;</td>
<td>240&quot;</td>
<td></td>
<td>1&quot;</td>
</tr>
</tbody>
</table>
.2 Install hangers to provide minimum ½" clear space between finished covering and adjacent work.

.3 Use oversize hangers to accommodate pipe insulation thickness. For pipes up to 2" use high density rigid pipe insulation at hanger location, with an insulation protection shield. For pipes 2½" and over use insulation protection saddle.

.4 Place a hanger within 12" of each horizontal elbow.

.5 Use hangers which are vertically adjustable 1½" minimum after piping is erected.

.6 Support cast iron horizontal drainage pipe near each hub and on each side of gasket and clamp joints, with 60" maximum spacing between hangers.

.7 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.8 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.9 Where practical, support riser piping independently of connected horizontal piping.

.10 Support plastic piping in accordance with manufacturers’ recommendations.

3.3 **Duct Hangers and Supports**

.1 Support duct work in accordance with SMACNA, and as a minimum as follows.

3.4 **Duct Hangers and Supports**

.1 Support duct work in accordance with SMACNA, and as a minimum as follows:

.1 **Low Pressure Duct Hangers and Supports**

.1 Hanger Minimum Sizes:

- Up to 30" wide: 1" x 16 gauge at 10'-0" spacing;
- 31" to 48" wide: 1½" x 16 gauge at 10'-0" spacing;
- Over 48" wide: 1½" x 16 gauge at 11'-0" spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

- Up to 18" wide: 1½" x 16 gauge or 1" x 12 gauge at 8'-0" spacing;
- 19" to 40" wide: 1½" x 1½" x 12 gauge at 4'-0" spacing.
.2 Medium Pressure Duct Hangers and Supports

.1 Rectangular Duct Hangers Minimum Sizes:

   Up to 36” wide: 2 at 1” x 16 gauge at 10'-0” spacing;
   37” to 60’ wide: 2 at 1” x 16 gauge at 8'-0” spacing and
   2” x 2” x ¼” trapeze;
   61” to 120” wide: 2 at 1½” x 12 gauge at 8'-0” spacing and
   2” x 2” x ¼” trapeze;
   128” to 240” wide: 3 at 3/8” diameter at 4'-0” spacing and
   2½” x 2½” x ¼” trapeze.

.2 Round Duct Hangers Minimum Sizes:

   At 10'-0” spacings;
   Up to 18” diameter: 1” x 16 gauge;
   19” to 36” diameter: 1” x 12 gauge;
   37” to 50” diameter: 1½” x 12 gauge.

3.5 Access Doors

.1 Provide access doors for maintenance or adjustment purposes for all
mechanical system components including:

   .1 Valves
   .2 Volume and splitter dampers
   .3 Fire Dampers
   .4 Cleanouts and traps
   .5 Coils and terminal units
   .6 Expansion joints
   .7 Control components

.2 Mark removable ceiling tiles used for access with color coded pins. See
Painting and Identification.

.3 Sizes to be 24” x 24” minimum.

.4 Provide UL-listed fire rated access doors installed in rated walls and ceilings.
3.6 Fire Rated Penetrations

.1 Install fire stop caulking on pipe penetrations through fire rated floors and walls. Refer to architectural documents for definition of rated construction components.

.2 Install fire stop device on all plastic pipe penetrations through rated walls and ceilings. Refer to Architectural documents for definition of rated construction components. Refer also to the Alberta Building Code.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Identification for mechanical equipment, piping systems and related components.

1.2 Related Requirements

.1 Submittals Division 01

1.3 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 Pipe and Pipe Fittings Section 20 20 10

.3 Piping and Equipment Insulation Section 20 20 30

.4 Fire Suppression Division 21

.5 Plumbing Division 22

.6 Heating, Ventilation and Air Conditioning Division 23

1.4 Quality Control

.1 Coordinate painting of piping and equipment with work of Section 09 91 30.

.2 Colour code mechanical equipment, piping and exposed ductwork. Refer to label identification schedules.

.3 Submit a schedule of pipe and equipment identification methods, materials and colours to the Engineer’s representative for review.

1.5 Reference Standards

.1 ASME A13.1 – Scheme for the Identification of Piping Systems.


.3 Federal Standard 595C Colours.

2.0 PRODUCTS

2.1 Identification Labels

.1 Identification Labels for all mechanical piping and ductwork systems, to include:

.1 WHMIS Pictogram (as applicable), same colour as legend letters.

.2 A lettered legend on a coloured background, defining the contents in the pipe, its pressure and temperature and the information necessary to define the hazard.

.3 Arrows to define the direction of flow, same colour as legend letters.

.4 50 mm wide black tape at each end of the label, wrapped around the entire circumference of pipe/insulation to secure the Identification Labels.

.2 Identification Labels may be accomplished by paint, stenciling and/or factory fabricated labels. Labels shall cover full circumference of pipe or insulation.

2.2 Height Of Legend Letters And Numbers

.1 Height of Legend Letters and Numbers:

<table>
<thead>
<tr>
<th>Outside Diameter of Pipe or Covering (mm)</th>
<th>Height of Letters and Numbers (mm)</th>
<th>Length of Colour Field (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 to 32</td>
<td>13</td>
<td>200</td>
</tr>
<tr>
<td>38 to 51</td>
<td>19</td>
<td>200</td>
</tr>
<tr>
<td>64 to 150</td>
<td>32</td>
<td>300</td>
</tr>
<tr>
<td>200 to 250</td>
<td>64</td>
<td>600</td>
</tr>
<tr>
<td>Over 250</td>
<td>89</td>
<td>800</td>
</tr>
</tbody>
</table>

.2 Lettering and Direction of Flow Arrow:

.1 Lettering: Capital, Bold, Sans Serif, Century Gothic or Helvetica.

.2 For hazardous piping system: black letters and arrows.

.3 Fire protection, other piping systems and ductwork: white letters and arrows, unless otherwise specified.
2.3 Valve Tags, Directories And Nameplates

.1 Valve Tags: 40 mm diameter with 20 mm lettering; brass, lamicoid or metal photo black numbers, secured to valve stem with key chain.

.2 Valve Directories: laminated sheets and electronic copy. Include the following information for each tagged valve:

.1 Valve identifier (valve number or logical point mnemonic).
.2 Location.
.3 Service.
.4 Make/model/size and CV for control valves.

.3 Engraved Plastic Nameplates: self-adhesive composite laminated plastic nameplates with one smooth white surface and core of black plastic designed to leave black lettering on a white background. Engraved lettering height as follows:

.1 All major equipment: 20 mm
.2 Air terminal boxes: 20 mm
.3 Magnetic contactors and VFDs: 20 mm
.4 All other: 8 mm

3.0 EXECUTION

3.1 General

.1 Identify piping systems and ductwork systems with Identification Labels. Refer to Article 3.2 Identification Schedules.

.2 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". The colours shall conform to the following schedule:

.1 HVAC equipment and duct cleaning access yellow
.2 HVAC valves and dampers blue
.3 Plumbing equipment and valves green
.4 Control dampers and sensors black
.5 Fire, smoke, and sprinkler equipment red

When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.
3.2 Identification Schedules

.1 Colour numbers for Identification Labels on piping systems, valves and equipment are defined in Federal Standard 595C Colours for colour code identification.

- Black : 17038
- Yellow : 13591
- Green : 14193
- Orange : 12473
- Brown : 10115
- Red : 11350
- White : 17860
- Aluminum : 16515
- Blue : 15180
- Grey : 16293
- Light Blue : 15450
- Purple : 17155

.2 Pipe Identification Label Schedule:

<table>
<thead>
<tr>
<th>Service</th>
<th>Background</th>
<th>Lettering</th>
<th>WHMIS Symbol</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprinkler</td>
<td>Red</td>
<td>White</td>
<td>N/A</td>
<td>WET SPRINKLER</td>
</tr>
<tr>
<td>Wet Stand Pipe</td>
<td>Red</td>
<td>White</td>
<td>N/A</td>
<td>WET STANDPIPE</td>
</tr>
<tr>
<td>Heating Hot Water</td>
<td>Yellow</td>
<td>Black</td>
<td>N/A</td>
<td>HOT WATER HEATING</td>
</tr>
<tr>
<td>Supply</td>
<td></td>
<td></td>
<td></td>
<td>SUPPLY</td>
</tr>
<tr>
<td>Heating Hot Water</td>
<td>Yellow</td>
<td>Black</td>
<td>N/A</td>
<td>HOT WATER HEATING</td>
</tr>
<tr>
<td>Return</td>
<td></td>
<td></td>
<td></td>
<td>RETURN</td>
</tr>
<tr>
<td>Freon-Liquid</td>
<td>Grey</td>
<td>White</td>
<td>Yes</td>
<td>FREON</td>
</tr>
<tr>
<td>Freon-Gas</td>
<td>Grey</td>
<td>White</td>
<td>Yes</td>
<td>FREON</td>
</tr>
<tr>
<td>Drains</td>
<td>Aluminum</td>
<td>Green</td>
<td>N/A</td>
<td>DRAIN</td>
</tr>
</tbody>
</table>

.3 Ductwork:

Identify all ductwork with Identification Labels as follows, complete with directional arrows:

<table>
<thead>
<tr>
<th>Service</th>
<th>Background Colour</th>
<th>Legend</th>
<th>Lettering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return Air</td>
<td>Blue</td>
<td>RETURN AIR</td>
<td>White</td>
</tr>
<tr>
<td>Supply Air</td>
<td>Blue</td>
<td>SUPPLY AIR</td>
<td>White</td>
</tr>
<tr>
<td>Outdoor Air</td>
<td>Blue</td>
<td>MIXED AIR</td>
<td>White</td>
</tr>
</tbody>
</table>
Identify duct access panels with Identification Labels, conforming to the following schedule:

<table>
<thead>
<tr>
<th>Identification</th>
<th>Background</th>
<th>Lettering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning and service access</td>
<td>yellow</td>
<td>Black</td>
</tr>
<tr>
<td>Controls, including heat sensors</td>
<td>black</td>
<td>White</td>
</tr>
<tr>
<td>Dampers (backdraft, balance and control)</td>
<td>blue</td>
<td>White</td>
</tr>
<tr>
<td>Fire dampers</td>
<td>red</td>
<td>White</td>
</tr>
<tr>
<td>Smoke dampers and detectors</td>
<td>red</td>
<td>White</td>
</tr>
</tbody>
</table>

Equipment Bases/Housekeeping Pads:

Grey, with 100 mm yellow and black angled bands around edges.

Location Of Labels

.1 Orient labels on piping systems in visual sight lines while standing at floor levels.

.2 Locate labels as follows:
   .1 Upstream of valves.
   .2 Adjacent to changes in direction.
   .3 Branches.
   .4 Where pipes pass through walls or floors.
   .5 On straight pipe runs at 6 m intervals.
   .6 Where system is installed in pipe chases, ceiling spaces, shafts, or similar confined spaces, at entry and exit points and at access openings.
   .7 At beginning and end points of each run and at each piece of equipment.

.3 Adhere labels to piping/insulation. Labels to cover entire pipe circumference. Secure both ends of labels with 50 mm wide black tape around the entire pipe circumference.

Visible (Exposed) Ductwork

.1 Paint visible ductwork as directed by Architect. Refer to Section 09 91 00.

.2 Paint ductwork/flexible connectors that are visible behind grilles/diffusers, matt black. Refer to Section 09 91 00.

Mechanical Control Identification

.1 Refer to Section 20 30 33.
3.6 Record Provisions

.1 Mark valve numbers on Red Line system schematic drawings for transfer onto record drawings. Include copies in O & M Manuals.

3.7 Valve Tags

.1 Tag pneumatic/electric controls, instruments and relays. Key to control schematics on which instruments are numbered in sequence.

.2 Tag all valves in mechanical rooms.

.3 Tag all control valves external to mechanical rooms. This includes control valves on radiant panels, perimeter radiation and air terminal boxes.

.4 Tag all circuit balancing and isolating valves external to mechanical rooms except valves at terminal heating and cooling equipment.

.5 Identify and tag pneumatic/electric thermostats relating to terminal unit and valve numbers.

3.8 Valve Directories

.1 Include laminated directories in operation and maintenance manuals. Also provide electronic copy in PDF, as well as spreadsheet user editable format.

3.9 Nameplates

.1 Identify the following with engraved plastic nameplates:

.1 All mechanical equipment.

.2 Air terminal boxes.

.3 Pneumatic/electric thermostats.

.4 Electric starting switches, electric disconnects, remote push buttons and control panels.

.2 All nameplates to be mechanically fastened, easily visible without need to use ladder or extraordinary body position. Affix additional nameplates if necessary.

.3 Provide the Engineer with an example of the contents of each type of nameplate. Obtain approval prior to engraving.

END OF SECTION
1.0 GENERAL

1.1 Related Requirements

1.1.1 General Mechanical Requirements
Section 20 05 01

1.1.2 General Documentation
Section 20 05 05

1.2 Related Work Specified In Other Sections

1.2.1 Refer to and comply with the following sections:

1.2.1.1 General Mechanical Provisions
Section 20 05 01

1.2.1.2 General Documentation
Section 20 05 05

1.2.2 Materials Testing
Section 20 05 07

1.2.3 Valves and Strainers
Section 20 05 23

1.2.4 Fire Suppression
Division 21

1.2.5 Plumbing
Division 22

1.2.6 Heating, Ventilating and Air Conditioning
Division 23

1.3 Coordination With Work In Other Sections

1.3.1 Coordinate piping installation routes and elevations with installation of sprinkler, sheet metal and electrical work.

1.4 Quality Assurance

1.4.1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations.

1.4.2 Use welders fully qualified and licensed by Provincial Authorities.


1.4.4 Domestic Water, Drainage and Vent Piping: Federal, Provincial and Municipal codes.

1.4.5 Medical Compressed Air, Nitrogen Gas and Vacuum System Piping: CSA Z305.1, Non-Flammable Medical Gas Piping Systems.

1.4.6 Non specified pipe joining and pipe fitting methods such as T-drill and Press Fit are not permitted in any piping system covered under Division 20.
2.0 PRODUCTS

2.1 Pipe

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 Sanitary drainage, and vent, inside building, above ground</td>
<td>'DWV' copper, ASTM B306, Cast iron, CSA B70</td>
</tr>
<tr>
<td>.2 Hot water and glycol heating to 120°C</td>
<td>Steel, schedule 40, ASTM A53, Grade B, Type 'L' hard copper ASTM B88M</td>
</tr>
<tr>
<td>.3 Equipment drains and overflows</td>
<td>Schedule 40, galvanized steel, ASTM A120, Type 'L' hard copper, ASTM B88M</td>
</tr>
<tr>
<td>.8 Fire Protection</td>
<td>Ferrous Piping: to NFPA13</td>
</tr>
<tr>
<td>.9 Refrigerant</td>
<td>ACR copper, ASTM B280</td>
</tr>
</tbody>
</table>

2.2 Fittings & Joints

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
<th>Joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sanitary drainage and vent, inside building, above ground</td>
<td>XFR PVC - DWV</td>
<td>Solvent weld</td>
</tr>
<tr>
<td>2. Hot water and glycol heating to 120°C</td>
<td>Banded malleable iron, 1035 kPa, up to 50 mm, Steel, same schedule as pipe, for sizes 50 mm and larger</td>
<td>Threaded up to 50 mm, Welded mechanical with angle pattern bolt pad 50 mm and larger</td>
</tr>
<tr>
<td>3. Equipment drains and overflows</td>
<td>Galvanized banded malleable iron</td>
<td>Threaded</td>
</tr>
<tr>
<td>4. Fire protection</td>
<td>Wrought copper, bronze, Cast brass</td>
<td>50-50 Solder, Screwed</td>
</tr>
<tr>
<td>10. Refrigerant</td>
<td>Malleable iron or cast iron, Banded malleable iron or steel</td>
<td>Threaded or Flanged, Grooved Mechanical</td>
</tr>
</tbody>
</table>

11. Use factory fabricated butt welded fittings for welded steel pipes.
12. Use long radius elbows for steel and cast iron water piping, including grooved mechanical fittings.
2.3 **Unions, Flanges, and Couplings**

.1 Size 50 mm and under: 1035 kPa malleable iron, bronze to iron ground joint unions for threaded ferrous piping, air tested for gas service, all bronze for copper piping.

.2 Flange bolting: For systems up to 120°C, use carbon steel stud bolts, semi-finished, and heavy hex nuts, ASTM A307-GrB. For systems up to 215°C, use alloy steel bolts ASTM A193-GrB7, and semi-finished heavy hex nuts ASTM A194-Gr2H.

.3 Rigid grooved mechanical couplings to be used on sprinkler system only to requirements of NFPA 13 shall provide system support and hanging requirements in accordance with ASME B31.1.

3.0 **EXECUTION**

3.1 **Preparation**

.1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

.2 Protect all steel pipes when stored on site from external conditions and ensure protective coating remains intact. If in the opinion of the Engineer, deterioration of the protective coating has instigated corrosion, all rust must be removed down to bare metal and prime coated with red oxide paint.

.3 Use roll grooving tools to groove pipe in accordance with manufacturer's specifications. Use copper rolls for copper pipe and stainless steel rolls for stainless steel pipe.

3.2 **Connection**

.1 Screw joint steel piping up to and including 40 mm. Weld piping 65 mm and larger, including branch connections. Screw or weld 50 mm piping for liquid systems, weld 50 mm piping for air and gas systems.

.2 Make screwed joints with full cut standard taper pipe threads with approved Teflon tape or non-toxic joint compound applied to male threads only, equal to Jet-Lube V-2 multi-purpose thread sealant.

.3 Make joints for plain end pipe with gasket and clamp type mechanical fastener.

.4 Clamp cast iron water pipe at fittings with 20 mm rods and properly anchor and support.

.5 Use grooved mechanical couplings for sprinkler systems to NFPA13. All grooved components shall be of one manufacturer and conform to local code approval. A gauged torque wrench must be used if required by the manufacturer.
.6 Make connections to equipment, specialty components, and branch mains after isolation valves, with unions or flanges.

.7 Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

.8 Use plastic isolation spacers for copper pipe installation in metal studs.

### 3.3 Route and Grades

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.

.2 Slope water piping 0.2% and provide hose bibb drains at low points.

.3 Equip low points with 20 mm drain valves and hose connections and caps.

.4 Provide air collection chambers with manual air vent at all high points of system. Collection chambers to be 25 mm dia. or line size whichever is greater and 150 mm high minimum. Square tees may only be used to assist with complete venting and draining.

.5 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water, bottom flat for steam.

.6 Grade horizontal drainage and vent piping 2% minimum.

.7 Pipe the discharge from all relief valves, safety valves, vents, drains, equipment blowdowns, water columns, and overflows to the nearest building drain.

### 3.4 Installation

.1 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.2 Configure all piping which crosses a building expansion joint with an expansion loop at the building expansion joint.

.3 Provide clearance for proper installation of insulation and for access to valves, air vents, drains, unions and clearance to combustibles.

.4 Minimum pipe size on heating water, chilled water and glycol system piping is 20 mm.
.5 Regardless of pipe and fitting materials specified in "Products" section of this specification section, all sanitary drainage piping within 10 m downstream of a sterilizer, relief valve or any device that may discharge fluid into the sanitary sewer above 60°C shall be cast iron.

.6 Pipe all drain pans on fan coil units, indoor premanufactured units, coils, computer room air conditioning units, unitary air conditioners, and outdoor premanufactured air handling units (with service corridor) to closest suitable funnel floor drain.

3.5 Plastic Pipe Installation

.1 Comply with the requirements and limitations defined in the Alberta Building Code.

3.6 Grooved Piping Systems

.1 Use grooved mechanical piping systems only on sprinkler systems.

.2 Use roll grooving tools to groove pipe to manufacturer's specifications. Provide regular bi-daily checks to confirm depth of groove is within manufacturer's tolerances. Use copper rolls for copper pipe and stainless steel rolls for stainless steel pipe.

.3 Confirm pipe ends are clean and free from indentations, projections or roll marks from pipe end to groove to ensure proper gasket sealing.

.4 Confirm that gasket style and grade are suitable for the intended service.

.5 Lubricate gaskets with a thin coat of lubricant to manufacturer's specifications; apply to gasket lips and exterior to ease installation and avoid pinching the gasket.
### 3.7 Welded Pipe Branch Connections

.1 Make branch connections according to the following schedule:

Legend:
- **T**: Forged tee or reducing tee
- **S**: Socolet
- **W**: Wedolet

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Branch Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 mm</td>
<td>T</td>
</tr>
<tr>
<td>20 mm</td>
<td>T T</td>
</tr>
<tr>
<td>25 mm</td>
<td>T T T</td>
</tr>
<tr>
<td>30 mm</td>
<td>T T T T</td>
</tr>
<tr>
<td>40 mm</td>
<td>T T T T T</td>
</tr>
<tr>
<td>50 mm</td>
<td>S S S T T T</td>
</tr>
<tr>
<td><strong>HEADER</strong> 65 mm</td>
<td>S S S S S T T T</td>
</tr>
<tr>
<td>75 mm</td>
<td>S S S S S S T T T</td>
</tr>
<tr>
<td>100 mm</td>
<td>S S S S S S T T T T</td>
</tr>
<tr>
<td>150 mm</td>
<td>S S S S S S W T T T T</td>
</tr>
<tr>
<td>200 mm</td>
<td>S S S S S S W W W T T T</td>
</tr>
<tr>
<td>250 mm</td>
<td>S S S S S S W W W W T T T T</td>
</tr>
<tr>
<td>300 mm</td>
<td>S S S S S S W W W W W T T T T</td>
</tr>
</tbody>
</table>

**BRANCH**

**END OF SECTION**
1.0 GENERAL

1.1 Scope

.1 Heating Systems: (heating hot water, heating glycol) ambient up to 232°C.

.2 Refrigerant Systems.

.3 Miscellaneous systems as scheduled.

.4 Adhesives, tie wires, tapes.

.5 Recovering.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 General Documentation Section 20 05 05

.3 Valves and Strainers Section 20 05 23

.4 Pipe and Pipe Fittings Section 20 20 10

.2 Plumbing Division 22

.3 Heating, Ventilation and Air Conditioning Division 23

1.3 Reference Documents

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C335 Steady State Heat Transfer Properties of Pipe Insulation

.2 ASTM C411 Hot-Surface Performance of High Temperature Thermal Insulation

.3 ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulating and Finishing Cement

.4 ASTM C547 Mineral Fiber Pipe Insulation

.5 ASTM C553 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
1.4 **Product Options And Substitutions**

.1 Refer to Division 01, Section 01 62 00, for requirements pertaining to product options and substitutions.

1.5 **Submittals**

.1 **Product Data**

.1 Submit manufacturer’s product data in accordance with Section 01 33 23 – Shop Drawings, Product Data & Samples, and Section 20 05 01 – General Mechanical Provisions.

.1 When requested, submit product data and test reports indicating that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements.
.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 23 – Shop Drawings, Product Data & Samples, and Section 20 05 05 – General Documentation.

.1 For each application submit an insulation schedule to include the following information:

.1 Materials
.2 "k" value
.3 Thickness
.4 Density
.5 Finish
.6 Jacketing

.3 Submit information showing installed insulation and membrane products meet the requirements of the Model National Energy Code of Canada for Buildings (MNECB), 1997 and ASHRAE 90.1-2010.

1.6 Definitions

.1 For the purposes of this Section, the following definitions apply:

.1 Concealed: piping systems and equipment in trenches, shafts, furring, interstitial spaces and suspended ceilings.

.2 Exposed: piping systems and equipment in mechanical rooms or otherwise not "concealed".

.3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

1.7 Flame/Smoke Development Ratings

.1 Pipe insulations, recovery materials, tapes, vapor barrier facings and adhesives shall have maximum flame spread rating of 25 and maximum smoke developed rating of 50, when tested in accordance with CAN/ULC-S102.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411.

1.8 Delivery, Storage, And Handling

.1 Deliver and store materials in original packaging with manufacturer's labels.

.2 Protect materials against damage from weather and construction activities.

.3 Separate waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
2.0 PRODUCTS

2.1 Hot Pipe Insulation

.1 Hot Pipe Insulation - Mineral Fibre:
   .1 Material: formed rigid mineral fibre insulation sleeving to ASTM C547.
   .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
   .3 Service Temperature: up to 150°C.
   .4 Jacket: factory applied general purpose jacket.

2.2 Insulated Hanger Inserts

.1 10kg density molded fiberglass, fibres oriented parallel to the direction of pipe to high compressive strength, noncombustible; fully resistant to water, oils, gasoline or common solvents, or, corrosion, odours, insects and oxidation, operating range -84°C to 232°C

.2 Length: 300 mm.

.3 Acceptable material: Hamfab H Block.

2.3 Cold Pipe Insulation

.1 Cold Pipe Insulation: Mineral Fibre:
   .1 Material: formed mineral fibre rigid insulation sleeving to ASTM C547.
   .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
   .3 Service Temperature: -14°C to 100°C.
   .4 Jacket: factory applied vapor barrier jacket to CGSB 51-GP-52Ma, Type 1, with longitudinal lap seal.

2.4 Accessories

.1 For mineral fibre insulation materials:
   .1 FSK Tape: vapor barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self-adhesive.
   .2 ASJ Tape: vapor resistant tape consisting of all service jacket material with pressure sensitive self-adhesive.
   .3 Adhesive: quick setting adhesive for joints and lap sealing.

.2 Thermal Insulating and Finishing Cement: to ASTM C449 mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.
2.5 Recovery Materials

.1 PVC: to CAN/CGSB-51.53-95, 0.38 mm thick for interior use, off-white in color with one-piece premoulded fitting covers.

.2 Aluminum: to 0.5 mm thick smooth with longitudinal slip joints and 50 mm end laps, 0.4 mm thick die shaped fitting covers with factory attached protective liner on interior surface.

3.0 EXECUTION

3.1 Installation, General

.1 Provide for all new systems and where existing systems damaged in course of work.

.2 Apply insulation after required piping system tests have been completed, witnessed and certified.

.3 Ensure piping surface is clean and dry before insulating.

.4 Install in accordance with TIAC National Standards.

.5 Install in accordance with manufacturers recommendations.

.6 Ensure insulation is continuous through walls and floor penetrations.

.7 Locate cover seams in least visible locations.

.8 Stagger butt joints where multi-layered insulation is used.

.9 On vertical piping with diameters 25 mm and larger, use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Repeat supports on 4.5 m centers and at each valve and flange.

.10 Tightly fit insulation sections to pipe to make smooth and even surfaces. Cut insulation for proper fit where weld beads protrude. Bevel away from studs and nuts to allow their removal without damage to insulation. Trim closely and neatly around extending parts of pipe saddles, supports, hangers, clamp guides and seal with insulating/finishing cement.

3.2 Hot Pipe Insulation Application

.1 Apply mineral fibre insulation when pipe surface temperatures are 50°C to 60°C.

.2 Apply mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Seal butt joints with 100 mm wide ASJ tape.

.3 Terminate mineral fibre insulation at each end of unions and flanges. Trowel finishing cement into bevel.

.4 Cover fittings and valves with equivalent thickness of tightly placed flexible insulation and apply PVC fitting covers.
.5 Cut mineral fibre insulation layers straight on 10 m centers with 25 mm gap to allow for expansion between terminations. Pack void tightly with insulation and protect joints with aluminum sleeves.

.6 Recover exposed mineral fibre insulated piping with PVC.

.7 Do not insulate the following piping system components:

.1 Hot water heating piping in radiation cabinets.
.2 Unions, flanges, strainers, expansion joints, flexible piping connectors.
.3 Chrome plated piping.
.4 Valve bonnets on domestic water systems.
.5 Drains, plugs and caps.

3.3 Cold Pipe Insulation Application

.1 Insulate 2 m portion of plumbing vents measured from roof outlet back. Do not insulate remaining vent piping.

.2 Insulate storm sewer piping throughout. Insulate final 2 m portion from outlet drain back with 25 mm insulation.

.3 Apply vapor retardant mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Apply adhesive to ends of butt joints and seal joint seams with 100 mm wide strips of joint tape.

.4 Insulate complete system including valves, unions, flanges, strainers, drains, caps and fittings. Seal lap joints with 100% coverage of joint tape and seal the assembly with vapor retardant adhesive. Insulate valves with tightly placed flexible insulation and apply reinforcing membrane embedded in vapor retardant coating and apply PVC fitting covers.

.5 Seal black rubber insulation butt joints and seams with black rubber insulation adhesive.

.6 Recover exposed mineral fibre insulated piping with aluminum.

.7 Recover mineral fibre insulated piping exposed to underground parking with aluminum.

3.4 Insulation Type And Thickness Schedule

<table>
<thead>
<tr>
<th>Service Type and Nominal Pipe Diameter (mm)</th>
<th>Insulation Type</th>
<th>Insulation Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Water Heating (up to 93°C): 40 and larger</td>
<td>Hot Pipe</td>
<td>38</td>
</tr>
<tr>
<td>Glycol Heating (up to 93°C): 40 and larger</td>
<td>Hot Pipe</td>
<td>38</td>
</tr>
<tr>
<td>Refrigerant Piping (5°C to 13°C): All Sizes</td>
<td>Cold Pipe</td>
<td>38</td>
</tr>
</tbody>
</table>

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Balance, adjust, and test air systems and equipment and submit reports using identical units to those shown on contract documents.

.2 Obtain sound level readings and submit reports for no less than 5% of the rooms within the building. Rooms where readings to be taken to be selected by the Engineer.

.3 Balance the Air-Handling Units to satisfy the airflow requirement in basement renovation.

.4 Balance the fan coil units to satisfy the airflow requirement in basement renovation.

.5 Air balance the air distribution systems including the VAVs, supply diffusers, and return air ducts.

.6 Calibrate all new and existing VAVs.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

  .1 General Mechanical Provisions Section 20 05 01
  .2 General Documentation Section 20 05 05

.2 Heating, Ventilation and Air Conditioning Division 23

1.3 Quality Assurance

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

.2 Balancing (of both air and liquid systems) and sound level readings shall be performed by the same agency.

.3 Balancing procedures shall be in accordance with SMACNA and ASHRAE Standards.

.4 During the one (1) year warranty period, the owner may request re-check or re-setting of outlets or fans as listed in test report. Provide technicians and equipment required during visits for seasonal adjustments.

1.4 Approved Agencies

.1 Precision, Accu-Air Technical Services Ltd., KESIL Test & Balance, TAB Air & Hydronic.
1.5 Site Visits

.1 One site visit shall be made to correspond with the general monthly site meetings held by the Owner. After each site visit, a written report shall be submitted to the Contractor and Engineer. Site visits shall commence after the start of air and liquid distribution work and be at 75% construction completion.

.2 A review of the installation and access to all valves, dampers, and equipment shall be made at the specified site visits and any additional dampers or valves required for proper balancing shall be forwarded in writing to be reviewed by the Engineer.

.3 Allow for one (1) visit of one (1) day to site to adjust systems for seasonal changes during warranty. Coordinate time of visits with the Owner. Submit reports to Engineer.

.4 Begin balancing after equipment start-up and testing and after systems have been completed and are in full working order. Place systems and equipment into full operation and continue operation during each working day of balancing.

1.6 Balancing Agenda

.1 General: Submit balancing agenda to the Engineer and commissioning contractor for review at least ten (10) days prior to the start of balancing work. Start balancing work only after agenda has been approved. Include descriptive data, procedure data, and sample forms in agenda.

.2 Descriptive Data: General description of each system including associated equipment and different operation cycles, listing of flow and terminal measurements to be performed.

.3 Procedure Data: Procedures for converting test measurements to establish compliance with requirements, specify type of instrument to be used, method of instrument application (by sketch) and correction factors.

.4 Sample Forms: Form showing application of procedures to typical systems.

1.7 Balance Report

.1 Submit the preliminary and final balancing report.

.2 Include types, serial number, and dates of calibration of instruments in the reports.
1.8 System Data

.1 Air Handling Equipment

Design Data:

Total air flow rate;
Fan total static pressure;
System static pressure;
Motor HP, r/min, amps, Volts, Phase;
Outside air flow rate cfm;
Fan r/min;
Fan/HP;
Inlet and outlet, dry and wet bulb temperatures.

Installation Data:

Manufacturer and model;
Size;
Arrangement discharge and class;
Motor type, HP, r/min, voltage, phase, cycles, and load amperage;
Location and local identification data.

Recorded Data:

Supply Air Fan
- Fan @ 100% Outside Air
  Air flow rate;
  Fan total static pressure;
  System static pressure;
- Fan @ Full Return/Min O/A
  Air flow rate;
  Fan total static pressure;
  System static pressure;

Return Air Fan
- Fan @ 100% Exhaust Air
  Air flow rate;
  Fan total static pressure;
  System static pressure;
- Fan @ Full Return
  Air flow rate;
  Fan total static pressure;
  System static pressure;
  Fan r/min;
For Axial Fans, note blade pitch angle
Motor operating amperage;
Inlet and outlet, dry and wet bulb temperatures.
.2 Duct Air Quantities - All supply mains.

Duct sizes;
Number of pressure readings;
Sum of velocity measurements;
Average velocity;
Duct recorded air flow rate;
Duct design air flow rate.

.3 Air Inlet and Outlets:

Outlet identification location and designation;
Manufacturers catalogue identification and type;
*Application factors;
Design and recorded velocities;
Design and recorded air flow rates;
Deflector vane or diffuser cone settings.

.4 Fan Coil Unit

Design Data:

Total air flow rate;
Fan total static pressure;
System static pressure;
Motor HP, r/min, amps, Volts, Phase;
Outside air flow rate cfm;
Fan r/min;
Fan/HP;
Inlet and outlet, dry and wet bulb temperatures.

Installation Data:

Manufacturer and model;
Size;
Arrangement discharge and class;
Motor type, HP, r/min, voltage, phase, cycles, and load amperage;
Location and local identification data.

.5 VAV:

Outlet identification location and designation;
Manufacturers catalogue identification and type;
Design and recorded air flow rates.
.6 Sound Level Data

Diagram or description of relationship of sound source and measuring instrument;
Scale reading;
Graph readings at each octave band frequency;
Calculate room N.C. levels.

2.0 PRODUCTS

2.1 Instruments

.1 Provide calibration histories for each instrument. Recalibration or use of other instruments may be requested when accuracy of readings is questionable.

3.0 EXECUTION

3.1 General Procedure

.1 Permanently mark, by stick-on labels and/or fluorescent paint, settings on valves, splitters, dampers, and other adjustment devices.

.2 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.3 Where vane anemometer is used to measure supply, return or exhaust air grilles, AK factors shall be determined as follows:

.1 Determine and tabulate similar sized grilles being balanced for AK schedule.

.2 Traverse all ducts serving grilles (outlined in AK schedule) to verify AK factors.

.3 AK factor from schedule, must be approved by Engineer during initial review with balancer on site. (Balancer shall include written procedure for determination of AK factors).

.4 No flow hoods are to be used for measurement of exhaust or return air grilles.

.4 Balancing shall be performed to the following accuracies:

.1 Air - terminal outlets ±10% (outlets less than 425 cfm)
.2 Air - terminal outlets ±5% (outlets greater than 425 cfm)
.3 Air - central equipment ±5%
3.2 **Air System Procedure**

.1 Perform balancing, adjusting, and testing with building doors and windows in their normal operation position.

.2 The following procedure shall be adopted for central systems:

   .1 Ensure dampers or volume control devices are in fully open position.
   .2 Balance central apparatus to ±5% air flow.
   .3 Balance branches and mains
   .4 Recheck central apparatus.
   .5 Balance all terminal air outlets
   .6 Re-balance central apparatus to ±5%.
   .7 Recheck all air outlets.
   .8 Balance all VAVs to maximum and minimum positions.

.3 When balancing air outlets:

   .1 Rough balance furthest outlets and then balance sequentially back to source.
   .2 Fine balance furthest outlet back to source.

.4 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross sectional area.

.5 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control only by duct internal devices such as dampers and splitters.

.6 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

.7 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).

.8 Verify all terminal unit factory settings for maximum air flow (and minimum if applicable). Adjust terminal unit controller if required. Record adjusted units.

.9 The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-storey building test pressure conditions at ground, intermediate and upper levels. Front doors, exits, elevator shafts, should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.10 Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.04"WG minimum and 0.08"WG maximum shall be achieved, measured with negligible outside wind velocity.
3.3  **Acoustical Measurements**

.1  Provide full spectrum acoustical measurements for each major area as follows:

.1  Office in basement renovation.

.2  Training room and meeting room in basement renovation.

.3  Separate acoustic measurements shall be taken as follows:

a) Rooms with single air outlet and not exceeding 107 ft$^2$ = 1 central reading
b) Rooms with multiple air outlets with an area less than 430 ft$^2$ = 2 @ 1/3 point readings
c) Rooms with multiple air outlets with an area exceeding 430 ft$^2$ = One reading in the center, and then readings at one-fifth and four-fifths points on each diagonal.

.2  Provide additional or repeat acoustical measurements as necessitated by final balancing of each space, system, or piece of equipment.

.3  Take measurements at maximum air volume conditions.

.4  Note room reflective conditions at time of readings (i.e. furnishings, window coverings, rugs).

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Complete system of automatic controls including all new thermostat control for new VAV boxes and new pneumatic controls.

.2 Control devices, components, wiring and material.

.3 Instructions to Owner.

1.2 Related Work Specified In Other Sections

.1 Renovation to existing VAV systems on the basement floor of the Central Building.

1.3 Quality Assurance

.1 The complete system of automatic controls for mechanical systems shall be supplied and installed by firms employing certified journeymen who specialize in this type of work and having proof of completing ten (10) projects of similar size and complexity.

.2 The equipment shall be of one manufacturer and installed by certified mechanics and electricians regularly employed by the manufacturer.

1.4 Submittals

.1 Submit shop drawings in accordance with Section 01 33 23 - Shop Drawings, Product Data and Samples.

.2 Include complete operating data, component setpoints, system drawings, wiring diagrams, electrical control schematics, written detailed sequences of operation and engineering data on each control system component. Include sizing as requested.

.3 Label components on drawings and identify as to function.

.4 Control components referenced to multiple systems or drawings to include page and point reference.

1.5 Warranty

.1 Include warranty provisions identified in contract.
1.6 System Activation

.1 Submit control component calibration check sheets prior to system acceptance. The check sheets to include sensor and controller calibration and equipment tag numbers.

.2 In addition to service required for call backs, the controls manufacturer shall provide two (2) complete inspections; one (1) in heating and one (1) in cooling season.

.3 Adjust control system as required; submit written reports to the Engineer.

2.0 PRODUCTS

2.1 Manufacturers

.1 Only Serv-All Mechanical Services is the approved controls contractor.

2.2 Manufacturers

.1 Provide system components consisting of thermostats, control valves, dampers, operators, indicating devices, interface equipment and other apparatus required to operating mechanical system and to perform functions specified.

.2 Provide materials and work necessary to connect control components. Unless specified otherwise, self-contained valves, filter gauges, liquid level controllers and similar instruments are not supplied or installed by this section.

.3 Provide wire and wiring devices required for complete automatic temperature control system.

.4 Provide all labour and materials including wiring, conduit boxes, relays, required to connect electrical control parts for mechanical equipment and leave in operating condition.

.5 Conform to Canadian Electrical Code and other authorities having jurisdiction. Pay all permits and conform to Division 26 specification for conduit requirements.

.6 Coordinate motor, starter, switch and thermostat locations with electrical work.

.7 Open wiring is acceptable using plenum wire (FT-6) for current limiting circuits 24 volts or less and shall be neatly strapped to ceiling structure. All wiring in walls or mechanical rooms to be installed in conduit.

2.3 Thermostats

.1 Provide room thermostats with Celsius and Fahrenheit scale.

.2 Thermostat shall be proportional type with concealed thermostat set-point.
2.4 Actuators

.1 Provide pneumatic actuator for all new VAVs.

.2 Match new pneumatic actuator with the same manufacturer as existing.

2.5 Air Piping

.1 Piping shall be hard or soft drawn copper or polyethylene plastic tubing. Plastic tubing must meet current F.R. requirements.

.2 Use copper for all control air lines:

.1 Where lines are subject to damage or temperatures in excess of 200F.

.2 Where lines are run adjacent to heating pipes passing through a common sleeve, or where not readily accessible

.3 Where life support or warning systems are to be controlled including VAV box control and air system dampers.

.4 Where control air is supplied to fire and smoke dampers.

.5 Where lines are run exposed in mechanical rooms, parkade and maintenance shops.

.3 Leave two spares and pair of communication lines in bundled plastic tubing.

3.0 EXECUTION

3.1 Installation

.1 Verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate thermostats 1500 mm above floor.

3.2 New VAV Terminal Unit Control Systems Testing

.1 Provide for testing of all VAV control systems in the basement office as shown in the mechanical drawing unless otherwise noted.

.2 Provide for testing of the operation of damper actuator, controller, thermostat, control air tubing and damper, to ensure operation of VAV controller over full range of operation.
.3 Provide written report identifying the following:

.1 VAV reference tag.
.2 Control device reference tag where applicable.
.3 Status of each VAV control system including results of tests by individual part.
.4 General comment on terminal device overall condition.
.5 Make and model type of each tested part.
.6 Reporting by spreadsheet based matrix referenced to VAV tag is acceptable in a format similar to the following sample:

| .1 VAV tag: _____ |
| .2 Controller: Pass/Fail |
| .3 Actuator: Pass/Fail |
| .4 Thermostat: Pass/Fail |
| .5 Tubing: Pass/Fail |
| .6 Damper: Pass/Fail |
| .7 Provide new thermostat for all existing VAV. |

3.3 Control System Tubing

.1 Provide for replacement of control system tubing that fails the specified testing.

.2 Provide unit costing for the following:

| .1 Unit cost per lineal foot for replacement of failed control systems tubing. |

.3 Assist the air balancer with recalibrating the VAV box controllers.

3.4 Acceptance Testing

.1 A final operational acceptance test of seven (7) consecutive days shall be conducted to demonstrate that the system is functioning properly in accordance with the specifications.

.2 The correct operation of all monitored and controlled points shall be demonstrated as well as the operation and capabilities of all sequences, reports, specialized control programs and algorithms, diagnostics and all other software. Specific testing shall include but not be limited to:

| .1 Night Set-up. |
| .2 Night Setback |
| .3 Occupied |
.3 In the event of the failure of function, during the test, of any of the hardware components or software application or routines, the test will recommence and run until seven (7) failure-free test days have occurred.

.4 After successful completion of the acceptance test, the Engineer will issue written acceptance of the control system.

.5 Prior to acceptance of the work, submit hard copy and electronic copy on diskette of final data base listings.

3.5 **Sequence Of Operation**

.1 Pneumatic VAV Controls:

.1 On drop or rise in air temperature VAV to proportionally control its position.

**END OF SECTION**
1.0 GENERAL

1.1 Intent

.1 Provide complete, fully tested and operational fire protection systems to meet requirements described herein and in complete accord with applicable codes and ordinances. Include all costs to obtain all permits and to pay for all fees and charges, including inspection charges by the authorities that issue the permits, including third party engineering fees. Coordinate all related inspections.

.2 Contract documents of the Specifications and Drawings, are generally diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents. Provide adequate access space for maintenance and service.

.4 Coordinate the installation of this work under the direction of the mechanical trade. Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Engineer.

1.2 Related Work Specified In Other Sections

.1 Fire Detection and Alarm Division 26

1.3 Related Requirements

.1 Refer to and comply with the following specification sections and articles:

.1 Procurement and Contracting Requirements Division 00

.2 General Requirements Division 01

.3 Submittals Division 01

.4 Execution and Closeout Requirements Division 01

.5 Warranty Division 01

.6 Performance Requirements Division 01

.7 Commissioning Division 01

.8 General Mechanical Provisions Section 20 05 01

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Operating and Maintenance Manuals.

.3 Record Drawings.

1.2 Quality Assurance

.1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.

2.0 PRODUCTS

2.1 Operating and Maintenance Manuals

.1 Refer to and comply with:

.1 Project Record Documents

.2 Submit hydraulic calculations, signed/sealed by a Professional Engineer.

.3 Submit data in electronic format on CD disk and hard copies.

2.2 Related work specified in other sections

.1 Refer to and comply with the following sections:

.1 Documentation for Plumbing Section 22 05 05

.2 Documentation for HVAC Systems Section 23 05 05

2.3 Binders

.1 Provide four (4) hard copy sets of Operations and Maintenance Manuals for fire protection systems. Refer to and comply with Section 20 05 05 - General Documentation.

.2 Submit Operation and Maintenance Manuals in electronic format on four (4) CD disks.
2.4 Record Drawings

.1 Refer to Section Division 01 - Closeout Procedures.

.2 The contractor shall keep, on site, available to the Engineer at all times and particularly for each regularly scheduled site meeting, a complete set of prints, edge bound, that are to be updated daily showing any and all deviations and changes from the Contract Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.

.3 Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.

.4 Submit four (4) hard copies of record drawings and four (4) electronic copies on CD disk form. Provide at the end of completion of all Phases of work.

3.0 EXECUTION

3.1 General

.1 Submit documents to the Engineer for approval prior to transmitting to the Owner.

3.2 Record Drawings

.1 Enter dimensions from building line to all shut-off valves, and other similar elements.

.2 At substantial completion, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings, and change orders, to a set of disks to AutoCAD. Drafting quality layers, symbols, etc. shall be identical to original drawings. Prior to substantial performance, turn over four (4) completed set of disks and four (4) hard copy record drawings.

.3 Each "record" shall bear the Contractor's identification, the date of record and the notation "We hereby certify that these drawings represent the "Work Record of Construction". The Contractor's signature, Engineer's stamp and signature, and company seal shall be placed below that notation.

.4 Provide record drawings only at the completion of all phases or work.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Demonstration of fire suppression equipment and systems operations.

.2 Instruction seminars for owner's personnel.

1.2 Quality Assurance

.1 Work specified shall be performed by the fire suppression subtrade.

1.3 Related Work Specified in Other Sections

.1 Refer to and comply with the following sections:

.1 Systems Demonstration and Owner's Instruction Section 20 05 06

.2 Fire Systems and Alarm Division 26

2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION

3.1 General

.1 Fire protection subtrade shall arrange for presentation and demonstration of fire suppression equipment and systems by appropriate specialists and shall ensure that required manufacturer's representatives are in attendance.

.2 Coordinate demonstration and instruction agenda and schedule with the Mechanical Trade, Owner and Engineer.

.3 Coordinate demonstration and instruction agenda and schedule for work performed outside the contract with the Owner and Engineer.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Test standpipe system piping.

.2 Test sprinkler system piping.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

  .1 Materials Testing Section 20 05 07

  .2 Documentation for Fire Suppression Section 21 05 05

1.3 Quality Assurances

.1 Test equipment and material where required by specification or authority having jurisdiction to demonstrate its proper and safe operation.

.2 Test procedures in accordance with applicable portions of NFPA and other recognized test codes.

.3 Perform tests on-site to the satisfaction of the Engineer.

.4 Piping, fixtures or equipment shall not be concealed or covered until installation is inspected and approved by the Engineer. Provide written notice to the Engineer at least three (3) days in advance of tests or concealing of piping.

.5 Coordinate with engineer at start of the project, those tests that will require witnessing by the Engineer.

.6 Submit sample test certificate forms for review two (2) weeks prior to any testing on-site.

1.4 Submittals

.1 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

.2 Perform tests as specified. Include test certificates in Operating and Maintenance Manuals.

1.5 Liability

.1 Take charge of plant during tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration in this connection.
2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION

3.1 Pressure Tests

.1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy and date of calibration. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.

.2 Carry out tests for eight (8) hour period and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re-witnessing.

.3 Sprinkler System: Test as required by current edition of NFPA 13 and authorities having jurisdiction.

.4 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Performance testing of equipment.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions                                      Section 20 05 01
   .2 System Demonstration and Owner's Instruction                       Section 20 05 06
   .3 Equipment Testing and Start-Up                                     Section 20 05 08
   .4 Documentation for Fire Suppression                                  Section 21 05 05
   .5 Commissioning of Electrical Systems                                 Division 26

1.3 Related Requirements

Testing, Balancing and Adjusting                                      Section 20 22 00

1.4 Quality Assurance

.1 Use factory trained representatives and submit manufacturer's check sheets for starting all systems and equipment.

.2 Prior to starting, testing and adjusting processes, verify with Engineer any tests required to be witnessed. Provide sufficient notice to Engineer prior to commencement of procedures.

.3 Engineer shall be allowed to witness any testing, adjusting and starting procedures.

.4 Assume all costs associated with starting and testing, including the supply of testing medium.

.5 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.

.6 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.7 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.
.8 Some processes involved in starting procedures defined in this section may be duplications of authorities’ verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.9 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of fire suppression equipment and systems being checked and shall be able to interpret results of the readings and tests.

.10 Assume all liabilities associated with starting, testing and balancing procedures.

2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION

3.1 General

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.3 Confirm voltages and operating amperages at full load.

.4 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.

3.2 Procedures

.1 Procedure shall be identified in the following five (5) distinct phases:

.1 Pre-Starting: Visual inspection.

.2 Starting: Actual starting procedure.

.3 Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.

.4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.

.5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.
.2 Check specified and shop drawing data against installed data.

.3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

3.3 Contractor Testing Responsibilities

.1 Sprinkler Systems
   .1 Test sprinkler system as per NFPA 13.

.2 Fire Extinguishers
   .1 Check that no pressure drop occurs over a twenty (20) day period.

END OF SECTION
1.0 GENERAL

1.1 Quality Assurance

.1 Welding materials, fabrication standards and labour qualifications must conform to ANSI/ASME B31.1, ANSI B16.25, ASME Section IX, and the Provincial Board of Labour Regulations.

.2 Use welders fully qualified and licensed by Provincial Authorities.


.4 Non-specified pipe joining and pipe fitting methods such as T-drill and Press Fit are not permitted in any piping system covered under Division 21.

2.0 PRODUCTS

2.1 Pipe

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
</tr>
</thead>
</table>

2.2 Fittings & Joints

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
<th>Joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fire protection</td>
<td>Malleable iron or cast iron</td>
<td>Threaded or Flanged</td>
</tr>
<tr>
<td></td>
<td>Banded malleable iron or steel</td>
<td>Grooved Mechanical</td>
</tr>
<tr>
<td></td>
<td>Steel, same schedule as pipe</td>
<td>Welded</td>
</tr>
</tbody>
</table>

2.3 Unions, Flanges, and Couplings

.1 Size 50 mm and under: 1035 kPa malleable iron, bronze to iron ground joint unions for threaded ferrous piping, air tested for gas service, all bronze for copper piping.

.2 Sizes 65 mm and over: 1035 kPa forged steel welding neck flanges for ferrous piping, 1035 kPa bronze slip-on flanges for copper piping. Gaskets shall be 1.5 mm thick pre-formed ceramic fiber.

.3 Flange bolting: For systems up to 120°C, use carbon steel stud bolts, semi-finished, and heavy hex nuts, ASTM A307-GrB. For systems up to 215°C, use alloy steel bolts ASTM A193-GrB7, and semi-finished heavy hex nuts ASTM A194-Gr2H.
4. Rigid grooved mechanical couplings shall have an angle bolt pattern design and shall provide system support and hanging requirements in accordance with ASME B31.1. Rigid couplings shall be used in all locations unless otherwise noted. Standard of acceptance Victaulic Style 07.

3.0 EXECUTION

3.1 Preparation

1. Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

2. Protect all steel pipes when stored on site from external conditions and ensure protective coating remains intact. If in the opinion of the engineer, deterioration of the protective coating has instigated corrosion, all rust must be removed down to bare metal and prime coated with red oxide paint.

3. Use roll grooving tools to groove pipe in accordance with manufacturer's specifications. Use copper rolls for copper pipe and stainless steel rolls for stainless steel pipe.

3.2 Connection

1. Threaded joint steel piping up to and including 40 mm. Weld piping 65 mm and larger, including branch connections. Screw or weld 50 mm piping for liquid systems, weld 50 mm piping for air and gas systems.

2. Make threaded joints with full cut standard taper pipe threads with approved Teflon tape or non-toxic joint compound applied to male threads only, equal to Jet-Lube V-2 multi-purpose thread sealant.

3. Use grooved mechanical couplings and mechanical fasteners where allowed, in accessible locations and mechanical rooms and where access can be obtained without removal of equipment or other materials such as ductwork etc. All grooved components shall be of one manufacturer and conform to local code approval. A gauged torque wrench must be used if required by the manufacturer.

4. Use galvanized couplings with galvanized pipe.

5. Make connections to equipment, specialty components, and branch mains after isolation valves, with unions or flanges.

6. Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters are acceptable.
3.3 Route and Grades

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.

.2 Slope water piping 0.2%.

.3 Equip low points with 20 mm drain valves and hose connection and cap.

.4 Make reductions in water and steam pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water.

.5 Grade horizontal drainage and vent piping 2% minimum.

.6 Pipe the discharge from all relief valves, safety valves, vents, drains, water columns, and overflows to the nearest building drain.

3.4 Installation

.1 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.2 Configure all piping which crosses a building expansion joint with an expansion loop at the building expansion joint.

.3 Provide clearance for proper access to valves, air vents, drains and unions.
### 3.5 Welded Pipe Branch Connections

.1 Make branch connections according to the following schedule:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Legend</th>
<th>T: Forged tee or reducing tee</th>
<th>S: Socolet</th>
<th>W: Weldolet</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 mm</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 mm</td>
<td>T</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>30 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>40 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>50 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>65 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>75 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>100 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>150 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>200 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>250 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>300 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
</tbody>
</table>

**HEADER**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Legend</th>
<th>T: Forged tee or reducing tee</th>
<th>S: Socolet</th>
<th>W: Weldolet</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>75 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>100 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>150 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>200 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>250 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>300 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
</tbody>
</table>

**BRANCH**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Legend</th>
<th>T: Forged tee or reducing tee</th>
<th>S: Socolet</th>
<th>W: Weldolet</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 mm</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 mm</td>
<td>T</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>30 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>40 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>50 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>65 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>75 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>100 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>150 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>200 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>250 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>300 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Legend</th>
<th>T: Forged tee or reducing tee</th>
<th>S: Socolet</th>
<th>W: Weldolet</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 mm</td>
<td>T</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 mm</td>
<td>T</td>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>30 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>40 mm</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>50 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>65 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>75 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>100 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>150 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>200 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>250 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
<tr>
<td>300 mm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>W</td>
</tr>
</tbody>
</table>

**END OF SECTION**
1.0 GENERAL

1.1 Scope

.1 Pipe hangers and supports.

.2 Sleevings for mechanical equipment.

1.2 Reference Standards

.1 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for the Installation of Sprinkler Systems.

1.3 General Requirements

.1 Provide hangers and supports to secure piping and equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.

.2 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.

.3 Select hangers and supports for the service and in accordance with manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.

.4 Fasten hangers and supports to building structure or inserts in concrete construction.

.5 Provide and set sleeves or block-outs required for equipment, including openings required for placing equipment.

.6 Provide sleeves for all piping through rated assemblies.

.7 Provide sleeves for all piping through ceilings and floors.

.8 Do not weld piping or equipment supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the Structural Engineer.

.9 Obtain approval prior to drilling for insert and supports for piping system. Discuss and obtain approval for hanging systems and methods with Structural Engineer.

.10 Use of piping or equipment for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.

1.4 Submittals

.1 Submit shop drawings of each factory fabricated component.
2.0 PRODUCTS

2.1 Inserts

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 Pipe Hangers and Supports

.1 Hangers, Pipe Sizes 15 mm to 40 mm: Adjustable wrought galvanized steel clevis.

.2 Hangers, Pipe Sizes 50 mm and Over: Adjustable steel clevis.

.3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

.4 Wall Support, Pipe Sizes to 80 mm: Cast iron hook.

.5 Wall Support, Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp.

.6 Vertical Support: Steel riser clamp.

.7 Design hangers so they cannot become disengaged by movements of supported pipe.

.8 Provide copper plated hangers and supports for copper piping.

2.3 Hanger Rods

.1 Provide galvanized rods, threaded both ends, threaded one end, or continuous threaded.

2.4 Sleeves

.1 Pipes through Floors: Form with steel pipe or PVC sleeves.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.
3.0 EXECUTION

3.1 Inserts

.1 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed 100 mm minimum square steel plate and nut above slab.

3.2 Pipe Hangers and Supports

.1 Support horizontal steel and copper piping as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size mm</th>
<th>Distance Between Supports mm</th>
<th>Hanger Rod Diameter mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steel</td>
<td>Copper</td>
</tr>
<tr>
<td>15 to 20</td>
<td>1800</td>
<td>1500</td>
</tr>
<tr>
<td>25 to 40</td>
<td>2100</td>
<td>1800</td>
</tr>
<tr>
<td>50 to 65</td>
<td>3000</td>
<td>2400</td>
</tr>
<tr>
<td>80 to 100</td>
<td>3600</td>
<td>3000</td>
</tr>
<tr>
<td>150 to 300</td>
<td>4200</td>
<td>4000</td>
</tr>
<tr>
<td>350 to 450</td>
<td>6000</td>
<td></td>
</tr>
</tbody>
</table>

.2 Install hangers to provide minimum 15 mm clear space between adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.6 Where practical, support riser piping independently of connected horizontal piping.

3.3 Sleeves

.1 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.2 Piping passing through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Caulk both sides.

.3 Install chrome plated escutcheons where piping passes through finished surfaces.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Painting and Identification for fire suppression work.

1.2 Related Requirements

.1 Submittals

1.3 Quality Control

.1 Coordinate colour coding of piping and equipment.

.2 Colour code fire protection systems.

2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION

3.1 General

.1 Identify piping with labels, colour bands, and flow arrows. Provide identification at 15 m maximum intervals, before and after pipes passing through walls, at all sides of tees, behind access doors as required.

.2 Apply colour bands at both ends of the label with primary colour bands used to secure both ends of individual labels. Refer to colour schedule at end of this section.

.3 Provide 20 mm diameter brass, lamacoid or metal photo black numbers, secured to valve stem with key chain.

.4 Provide neat, typewritten directories, giving valve number, services and location. Include copies in O&M Manuals.

.5 Identify all equipment excluding pipe and duct with mechanically fastened lamacoid plates having 6 mm minimum letter size. Identification to match as built drawings equipment name and number.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Equipment, piping, including sprinkler heads, valves, hangers and supports, sleeves, and accessories.

.2 Contractor shall be responsible for coordination of all fire alarm interlocks with Division 26.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 Shop Drawings, Product Data & Samples Division 01
.2 Closeout Procedures Division 01
.3 General Provisions – Fire Suppression Section 21 05 01

1.3 General Requirements

.1 Provide labor and materials for a complete renovated sprinkler system as required by local codes and as indicated on drawings. Size of sprinkler system based on light hazard occupancy. Provide sprinklers for areas as indicated and as required, including specialized rooms. Run piping concealed above furred ceilings and in interstitial spaces. Expose only heads.

.2 Obtain residual pressure and flow data from the municipal utility. Base hydraulic system calculations on this data.

1.4 Quality Assurance

.1 Comply with the Alberta Building Code.

.2 Sprinkler equipment and installation shall be in accordance with the current edition of NFPA 13 - Standard for the Installation of Sprinkler Systems.

.3 Sprinkler equipment and installation shall be in accordance with the current standards required, and approved by the Authority Having Jurisdiction.

.4 Sprinkler equipment shall be installed by qualified contractors licensed and regularly engaged in installation of automatic fire sprinkler equipment.
1.5 Submittals

.1 Refer to Division 01, Shop Drawings, Product Data & Samples.

.2 Submit preliminary layout showing only head locations for review. Refer to architectural plans for ceiling coordinated head locations, space all others to Code Standard.

.3 Submit shop drawings, hydraulic calculations and equipment data of entire sprinkler system. Submitted drawings to be designed and stamped by a Professional Engineer regularly engaged in fire protection design and registered with APEGGA.

.4 Submit for approval, sample of all types of sprinkler heads to be used.

.5 Refer to Section 01 78 00 - Closeout Submittals.

.6 Upon completion of testing and certification to NFPA 13, submit C2 Schedule with the design engineers professional seal and signature.

.7 Submit record drawings on AutoCAD CD disks, four (4) required, consistent with O&M Manuals.

1.6 Engineering Design Criteria

.1 Design system in accordance with NFPA 13 using following parameters:

.1 Hazard: To suit occupancy classification based on the quantity and/or combustibility of the building contents.

.2 Pipe size and layout:

.1 Hydraulic design in accordance with NFPA standards and the Owner's Insurance Underwriter requirements, whichever is more stringent.

.2 Sprinkler head layout: to as indicated on reflected ceiling plans, while meeting or exceeding the requirements of NFPA 13.

.3 Allow for 10% additional sprinkler heads to accommodate final shop drawing approvals subject to architectural discipline review and provision.

.3 Zoning:

.1 System zoning is existing.

1.7 Maintenance Data and Materials

.1 Provide maintenance data for incorporation into manual specified in Section 21 05 05 - Documentation for Fire Suppression
2.0 PRODUCTS

2.1 Acceptable Contractors

.1 SimplexGrinnell, Vipond, Viking, Gisborne, Troy.

2.2 Pipe, Fittings, Valves, Supports, Sleeves

.1 Pipe and fittings and joints to conform to Section 21 05 09 - Pipe & Pipe Fittings for Fire Suppression.

.2 Pipe hangers, supports and sleeves shall conform to Section 21 05 29 - Hangers and Supports for Water Based Fire Suppression Piping.

.3 Pipe and valve identification shall conform to Section 21 05 53 - Painting and Identification for Fire Suppression.

2.3 Sprinklers

.1 Temperature rating on fusible links shall suit specific hazard area and ceiling temperature with minimum margin of safety 10°C.

.2 All sprinklers shall be of quick response type, and shall be designed and installed in accordance with their ULC listing AND shall match existing sprinklers.

.3 For suspended ceilings, provide fully-recessed sprinkler heads with cover finish to match colour of ceiling tiles.

.4 For drywall ceilings, provide concealed pendant type heads. Finish to match colour of the ceiling.

3.0 EXECUTION

3.1 Installation

.1 Install, inspect and test to acceptance with NFPA 13 and local authorities.

.2 Protect sprinkler heads against mechanical injury with standard guards when necessary.

.3 Provide on sprinkler system take-off from water supply ULC approved double check valve assembly.

.4 All sprinkler system isolation valves, shall have fire alarm contacts that can be monitored on the building fire alarm system. Coordinate contact type and wiring with Division 26.

.5 Centre heads in two directions in ceiling tile. Sprinkler head locations shall be located symmetrically within each room or area but shall not exceed the manufactures ULC listed maximum spacing.
.6 Locate zone shut-off valves in interstitial space as approved by the Engineer.

.7 Arrange sprinkler piping and provide auxiliary drain valves such that it is completely drainable. Extend drain lines to the floor level within the reach of a floor drain with a 15 m hose.

.8 Provide sprinkler flow test connections as per NFPA 13.

.9 Identify all piping and isolation valves in accordance with Section 21 05 53 - Painting and Identification for Fire Suppression.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Fire extinguishers and fire extinguisher cabinets.

1.2 General Requirements

.1 Provide portable hand extinguishers where indicated on drawings and specified herein.

1.3 Quality Assurance

.1 Comply with the Alberta Building Code.

.2 Fire protection equipment and installation shall be approved by local Fire Commissioner.

.3 Equipment and installation shall meet the requirements of NFPA No. 10 Portable Fire Extinguishers.

1.4 Submittals

.1 Submit shop drawings for review.

2.0 PRODUCTS

2.1 Acceptable Manufacturers

.1 Fire extinguishers: National, Flag, Kidde, CFH.

.2 Fire extinguisher cabinets: Williams Brothers, National Fire Equipment

2.2 Portable Hand Fire Extinguishers

.1 Multi-purpose Dry Chemical ABC (Type 1): Stored pressure with hose and shut-off nozzle or integral shut-off nozzle and mounting brackets 4.5 kg capacity rating 4A:60BC.

2.3 Fire Extinguisher Cabinets and Brackets

.1 Recessed Fire Extinguisher Cabinet: 1.6 mm steel construction with 2.7 mm fully opening door in adjustable frame, 6 mm acrylic full panel door, approved latching device, gray baked enamel finish, size to accommodate 4.5kg dry chemical fire extinguisher.
3.0 EXECUTION

3.1 Installation

.1 Install extinguisher cabinet so that the bottom of the extinguisher cabinet is 914 mm from the floor.

.2 Use extinguisher cabinet mounting hardware appropriate to the fire extinguisher cabinet. Minimum two screws each at both the top and bottom rear of cabinet anchored to the building structural members or backing attached to the structural members.

.3 Use fire extinguishers where shown on drawings.

END OF SECTION
1.0 GENERAL

1.1 Related Requirements

.1 Refer to and comply with the following sections:

.1 Procurement and Contracting Requirements Division 00
.2 General Requirements Division 01
.3 Shop Drawings, Product Data & Samples Division 01
.4 Closeout Procedures Division 01
.5 General Mechanical Provisions Section 20 05 01

1.2 Related Work Specified In Other Sections

2.0 PRODUCTS - NOT APPLICABLE

3.0 EXECUTION

3.1 General

.1 Execute mechanical systems installation in accordance with the sections listed in Articles 1.1 and 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Shop Drawings.

.3 Operating and Maintenance Manuals.

.4 Record Drawings.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 General Documentation Section 20 05 05

.3 Equipment Testing and Start-Up Section 20 05 08

2.0 PRODUCTS

2.1 General

.1 Supply shop drawings, O&M Manuals and samples as defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Complete documentation and submittals in accordance with procedures defined in the sections listed in Articles 1.1 and 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Test condensate piping.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 General Documentation Section 20 05 05

.3 Materials Testing Section 20 05 07

.2 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

.3 Submit copies of test results in Operating and Maintenance Manuals.

2.0 PRODUCTS

2.1 General

.1 Supply materials necessary to carry out testing procedures defined in the sections listed in Article 1.1 and 1.2.

3.0 EXECUTION

3.1 General

.1 Test systems outlined in Article 1.1 as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Performance testing of equipment.

.2 Manufacturer's start-up of equipment.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 General Documentation Section 20 05 05

.3 Systems Demonstration and Owner's Instruction Section 20 05 06

.4 Equipment Testing and Start-Up Section 20 05 08

.5 Controls Section 20 30 Series

1.3 Related Requirements

.1 Plumbing Performance Requirements Division 01

.2 Electrical Commissioning Division 26

2.0 PRODUCTS

2.1 General

.1 Supply all materials necessary to start-up and test mechanical systems as defined in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Start and test mechanical systems and equipment as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Pipe hangers and supports.
.2 Slewing for mechanical equipment.
.3 Pipe anchors.
.4 Access doors (in walls and ceilings).

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:
  .1 General Mechanical Provisions Section 20 05 01
  .2 Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors Section 20 05 29

2.0 PRODUCTS

2.1 General

.1 Provide materials required for supporting pipe work and equipment as defined in the sections listed in Article 1.2.
.2 Provide materials required for flashing mechanical work, sleeving and sealing pipe penetrations as defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Install pipe and equipment hangers and supports as defined in the sections listed in Article 1.2.
.2 Install flashing, sleeving, sealing and access doors as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Painting and Identification for plumbing systems.

1.2 Related Work Specified in Other Sections

.1 Painting of Mechanical Work

.2 Refer to and comply with the following sections:

.1 General Mechanical Provisions

.2 General Documentation

.3 General Painting and Identification

.4 Pipe and Pipe Fittings

1.3 Quality Control

.1 Coordinate colour coding of piping and equipment with work of Section 09 91 30.

.2 For colour coding for Medical Gas, refer to C.S.A. Standard for Non-Flammable Medical Gas Piping Systems Z305.1.

2.0 PRODUCTS

2.1 General

.1 Provide materials for piping and equipment identification as defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Install pipe and equipment identification as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Drainage from fan coil units and HRV.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors Section 20 05 29

.3 Pipe and Pipe Fittings Section 20 20 10

.2 Sanitary Waste Piping Specialties Section 22 13 19

2.0 PRODUCTS

2.1 General

.1 Supply piping and accessories defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Install domestic waste and vent piping, test and document as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Cleanouts.

.2 New nickel bronze strainer and elongated funnel for existing floor drain.

1.2 Related Work Specified in Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05
.3 Pipe and Pipe Fittings Section 20 20 10

.2 Sanitary Waste and Vent Piping Section 22 13 16

1.3 General Requirements

.1 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes as specified herein.

.2 Provide drainage connections to equipment furnished in other sections of this specification and by the Owner.

.3 Provide and include charges for connections to Municipal and Utility Company services.

2.0 PRODUCTS

2.1 Acceptable Manufacturers

.1 Cleanouts : Watts, Zurn, Ancon.

.2 Nickel bronze strainer and elongated funnel for existing floor Drains: Watts, Zurn, Ancon.

2.2 Cleanouts and Cleanout Access Covers

.1 Provide caulked or threaded type extended to finished floor or wall surface. Ensure ample clearance at cleanout for rodding of drainage system.

.2 Provide round access covers in finished areas with depressed centre section to accommodate floor finish. Wall cleanouts to have chrome plated caps.

2.3 Nickel bronze strainer and elongated funnel

.1 Adjustable nickel bronze strainer with 4”X9” oval nickel bronze funnel.
3.0 EXECUTION

3.1 Installation

.1 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover, remove cleanout plugs, re-lubricate and re-install using only enough force to ensure permanent leak proof joint.

.2 Drainage lines shall grade 2% per foot unless otherwise noted on drawings.

END OF SECTION
1.0 GENERAL

1.1 Intent

.1 Provide complete, fully tested and operational HVAC systems to meet requirements described herein and in complete accord with applicable codes and ordinances.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following section:

.1 General Mechanical Provisions Section 20 05 01

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION – NOT APPLICABLE

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Secure and assemble all necessary literature describing the operation and maintenance of all HVAC equipment provided. Complete and transmit documentation for review to Engineer at project milestones.

.2 Operating and Maintenance Manuals.

.3 Record Drawings.

.4 Vendor's certifications confirming their equipment is correctly installed prior to start-up and testing.

.5 Vendor's start-up and test reports.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions Section 20 05 01
   .2 General Documentation Section 20 05 05
   .3 Equipment Testing and Start-Up Section 20 05 08

2.0 PRODUCTS

2.1 General

   .1 Provide materials defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

   .1 Provide shop drawings, start-up and test results, O&M Manuals, and other documentation defined in the sections listed in Articles 1.1 and 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Test heating water piping.

.2 Test control air piping.

.3 Test low velocity ducts.

.4 Test medium and high velocity ducts.

.5 Test refrigerant piping.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions Section 20 05 01

   .2 General Documentation Section 20 05 05

   .3 Materials Testing Section 20 05 07

.2 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

.3 Submit copies of test results in Operating and Maintenance Manuals.

2.0 PRODUCTS

2.1 General

.1 Provide all equipment and materials required to complete systems testing as defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Test all systems defined in Article 1.1. Provide documentation and test in accordance with procedures outlined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Performance testing of equipment.
.2 Manufacturer's start-up of equipment.
.3 Submit copies of start-up and test reports in Operating and Maintenance Manuals.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05
.3 Systems Demonstration and Owner’s Instruction Section 20 05 06
.4 Equipment Testing and Start-Up Section 20 05 08

1.3 Related Requirements

.1 General Requirements Division 00
.2 Commissioning of Electrical Systems Division 26

2.0 PRODUCTS

2.1 General

.1 Provide materials and equipment required to complete work defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Complete HVAC systems start-up, testing, demonstrations, Owner's instructions and documentation defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Pipe hangers and supports.

.2 Duct hangers and supports.

.3 Slewing for mechanical equipment.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors Section 20 05 29

2.0 PRODUCTS

2.1 General

.1 Provide materials required for supporting piping, ductwork and equipment installations as defined in the sections listed in Article 1.2.

.2 Provide materials required for sealing pipe and duct penetrations as listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Install pipe, duct and equipment hangers and supports as defined in the sections listed in Article 1.2.

.2 Install flashing, slewing, sealing and access doors as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Reference Standard

.1 Provide and install mechanical equipment so that Average Noise Criteria Curves, as outlined in ASHRAE Guide, are not exceeded.

1.2 General Requirements

.1 Supply vibration isolation equipment and materials by one supplier. Consider side loading of equipment and inertia bases when calculating maximum loads on isolators.

.2 Ensure equipment is sufficiently rigid for isolator point loading.

1.3 Product Options and Substitutions

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.4 Shop Drawings and Product Data

.1 Comply with requirements of Section 01 33 00.

.2 Provide schedule of vibration isolation devices prepared by the manufacturer to include:

.1 Type of isolator
.2 Service
.3 Location
.4 Static load
.5 Deflection
.6 Base dimensions

.3 Provide installation instructions.

1.5 Inspection

.1 Retain and pay for inspection services and report by manufacturer’s representative to confirm installation is in accordance with manufacturer’s recommendations.
2.0 PRODUCTS

2.1 Bases

.1 Type A: Integral structural steel fan and motor base with motor slide rail.

.2 Type B: Slung structural steel base with gussetted brackets and integral motor slide rail.

.3 Type C: Reinforced 20 MPa concrete inertia base with full depth perimeter structural channel frame with gussetted brackets and anchor bolts. Minimum mass of concrete 1.5 times mass of isolated equipment.

.4 Type D: Reinforced concrete equipment base with chamfered edges and Type 8 vibration isolator between base and housekeeping pad. Minimum mass of concrete at 1.5 times mass of isolated equipment.

2.2 Vibration Isolators

.1 Type 1: Closed spring mount with top and bottom housing separated with neoprene or rubber stabilizers.

.2 Type 2: Open spring mount with springs having a horizontal stiffness equal or greater than vertical stiffness.

.3 Type 3: Open spring mount with springs having a horizontal stiffness equal or greater than vertical stiffness and have a heavy mounting frame with limit stop.

.4 Type 4: Closed spring mount with spring having a horizontal stiffness equal or greater than vertical stiffness and have limit stops.

.5 Type 5: Closed spring hanger with elastomer washer in series with the spring.

.6 Type 6: Closed spring hanger with 25 mm thick elastomer isolator in series with the spring.

.7 Type 7: Elastomer mount with threaded metal insert and hold down holes in base plate.

.8 Type 8: Rubber waffle pads, durometer natural rubber, minimum 12 mm thick, maximum loading 415 kPa.

.9 Type 9: Neoprene-steel-neoprene pad, with 12 mm thick rubber waffle pads bonded to .6 mm steel plate.

2.3 Kinetic Isolation Pads

.1 50 mm thick solid neoprene isolators.

.2 Maximum deflection of pad not to exceed 7 mm.
3.0 EXECUTION

3.1 Base Assemblies

.1 Provide bases for equipment as specified in Vibration Control Schedule.

.2 Provide concrete housekeeping pad below pad. Anchor vibration isolators to the housekeeping base.

.3 Provide minimum 50 mm clearance between housekeeping pad and base.

.4 Attach horizontal control springs Type HCS to base of centrifugal fans to limit excessive deflections caused by starting torque.

.5 Ensure bases and housekeeping pads are level and clear of all debris.

.6 Support vertical piping to equipment from the base, not on the housekeeping pad or floor.

3.2 Vibration Isolators

.1 Select springs to operate at static deflections not greater than 2/3 solid deflection.

.2 Provide Type 8 isolators below all steel spring mounts.

.3 Colour code springs. Do not re-paint.

.4 Isolate all bolts used to secure isolators with rubber washers.

.5 Hot dip galvanize housings and neoprene coat springs where isolators are exposed to outdoors.

.6 Where deflection exceeds 5 mm use steel spring isolators. Where deflections are less than 5 mm, use neoprene isolators.

.7 Do not bend or offset spring hanger rods. Rods not to exceed 10° offset from vertical. Ensure springs do not deflect and touch surrounding steel body.

.8 Substitute neoprene for natural rubber on Types 8, 9 isolators on outdoor installations or where oil may contact the isolator.

3.3 Spring Isolated Piping Supports

.1 Where piping connects to vibration isolated devices, provide Type 5, 6 isolators on pipe hanger supports as follows:

.1 First three pipe hangers for pipe 100 mm or less.

.2 First four pipe hangers for pipe greater than 100 mm but less than 250 mm.

.3 First six pipe hangers for pipe 250 mm and larger.

.4 Size first spring hanger to deflect two times the static deflection of the isolated equipment, with maximum deflection of 50 mm. Minimum 25 mm deflection of subsequent hangers.
3.4 Sound and Vibration Penetrations

.1 Support piping passing through equipment room floors with a pipe clamp at floor level, supported from floor on Type 8 isolators.

.2 Caulk pipe and ducts passing through equipment room floors or walls on each side. Install lead sheeting around the opening to form a sound barrier.

3.5 Rubber Isolated Piping Supports

.1 Where domestic hot and cold piping to plumbing fixtures is supported in drywall partitions, install 3 mm thick neoprene rubber separation between bracket support and pipe.

3.6 Vibration Control Schedule

.1 Refer to Schedule on drawings.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Painting and identification for heating, ventilation and air conditioning systems.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions Section 20 05 01
   .2 General Documentation Section 20 05 05
   .3 Equipment Testing and Start-Up Section 20 05 08
   .4 General Painting and Identification Section 20 05 53

2.0 PRODUCTS

2.1 General

.1 Provide all materials and accessories required to complete HVAC systems painting and identification work defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Paint and identify HVAC systems as defined in sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Prepare the facility for balancing.

1.2 Related Requirements

.1 Starting and Adjusting Section 01 75 00

.2 Testing, Adjusting, and Balancing Section 01 91 00

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION

3.1 Installation

.1 Bring the work to an operating state and ready for balancing, including:

.1 Clean equipment and ductwork.

.2 Install air terminal devices.

.3 Install permanent instrumentation.

.4 Complete the "start-up" of equipment.

.5 Check rotation and alignment of rotating equipment and tension of belted drives for air-handling units that will be part of air-balancing.

.6 Set control points of automatic apparatus, check-out sequence of operation.

.7 Make available control diagrams and sequence of operation.

.8 Clean work, remove temporary tags, stickers, and coverings.

.9 Make available one (1) copy of Maintenance Manuals especially for use in balancing.

.10 Provide Balancing Agency a complete set of mechanical drawings and specifications.
.2 Cooperate with the Balancing Agency as follows:

.1 Make corrections as required by Balancing Agency.

.2 Allow Balancing Agency free access to site during construction phase. Inform Balancing Agency of any major changes made to systems during construction and provide a complete set of record drawings for their use.

.3 Provide and install any additional balancing dampers, and other materials requested by the balancing agency and/or necessary to properly adjust or correct the systems to design flows. Coordinate with Engineer for review.

.4 Operate automatic control system and verify set points during Balancing.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Balance, adjust, and test air and liquid systems and equipment and submit reports using identical units to those shown on contract documents.

.2 Obtain sound level readings and submit reports for no less than 5% of the rooms within renovated spaces. Rooms where readings to be taken to be selected by the Engineer.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions Section 20 05 01

   .2 Testing, Balancing and Adjusting Section 20 22 00

2.0 PRODUCTS

2.1 General

.1 Provide all equipment and materials required to complete testing, adjusting and balancing as defined in the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Carry out testing, balancing and adjusting procedures and submit documentation as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Duct thermal insulation.

.2 Duct acoustic insulation.

.3 Adhesives, tie wires, tapes.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following section:

.1 General Mechanical Provisions Section 20 05 01

.2 General Documentation Section 20 05 05

1.3 Reference Documents

.1 American Society for Testing and Materials (ASTM):

.1 ASTM B209M Specification for Aluminum and Aluminum Alloy Sheet and Plate

.2 ASTM C411 Standard Test Method for Hot-Surface Performance of High Temperature Thermal Insulation

.3 ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method


.5 ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.6 ASTM C921 Practice for Determining the Properties of Jacketing Materials for Thermal Insulation

.7 ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

.8 ASTM G21 Standard of Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
.2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
   .1 ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

.3 Canadian General Standards Board (CGSB):
   .1 CAN/CGSB-51.2 Thermal Insulation, Calcium Silicate for Piping, Machinery and Boilers
   .2 CAN/CGSB-51.9 Mineral Fiber Thermal Insulation for Piping and Round Ducting
   .3 CAN/CGSB-51.10 Mineral Fibre Board Thermal Insulation
   .4 CAN/CGSB-51.11 Mineral Fibre Thermal Insulation Blanket
   .5 CAN/CGSB-51.12-M86 Thermal Insulating and Finishing Cement
   .6 CGSB 51-GP-52Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation


.5 National Fire Protection Association (NFPA):
   .1 NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

.6 Underwriters Laboratories of Canada (ULC):
   .1 CAN/ULC-S102-10 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4 Product Options And Substitutions
   .1 Refer to Division 01 for requirements pertaining to product options and substitutions.
1.5 Submittals

.1 Product Data:

.1 Submit manufacturer’s product data in accordance with Section 20 05 05 – General Documentation.

.1 Submit product data and test reports when requested to substantiate that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements for the assembly and thickness used.

.2 Submit information showing installed insulation and membrane products meet the requirements of ASHRAE 90.1.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 20 05 05 – General Documentation.

.1 Submit an insulation schedule, for each application include the following information:

.1 Materials
.2 "k" value
.3 Thickness
.4 Density
.5 Finish
.6 Jacketing

1.6 Definitions

.1 For the purposes of this section, the following definitions apply:

.1 Concealed: ductwork and equipment in shafts, furring, suspended ceilings and attics.

.2 Exposed: ductwork and equipment in mechanical rooms or otherwise not "concealed".

.3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C) to ASTM C553.

1.7 Flame/Smoke Development Ratings

.1 Duct insulation, recovery materials, vapour barrier facings, tapes and adhesives shall have maximum flame spread rating of 25 and maximum smoke developed less than or equal to 50, when tested in accordance with CAN/ULC S102.

.2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411.
2.0 PRODUCTS

2.1 Hot Duct Insulation

.1 Hot Duct Insulation - Round and Oval:
   .1 Material: flexible mineral fibre blanket insulation to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma.
   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.
   .3 Service Temperature: 20°C to 65°C.

.2 Hot Duct Insulation - Rectangular
   .1 Material: rigid mineral fibre insulation to ASTM C612 with factory applied vapour retarder jacket to CGSB 51-GP-51Ma.
   .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
   .3 Service Temperature: 20°C to 65°C.

2.2 Cold Duct Insulation

.1 Cold Duct Insulation - Round and Oval:
   .1 Material: flexible mineral fibre blanket insulation to CAN/CGSB-51.11.
   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.
   .3 Service Temperature: -40°C to 65°C.
   .4 Jacket: factory applied reinforced aluminum foil vapour barrier to CGSB 51-GP-52Ma.

.2 Cold Duct Insulation - Round (Exposed to Outdoors):
   .1 Material: semi-rigid mineral fibre in roll form.
   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature
   .3 Service Temperature: -40°C to 65°C.
   .4 Jacket: factory applied reinforced aluminum for vapour barrier to CGSB 51-GP-52Ma.

.3 Cold Duct Insulation - Rectangular:
   .1 Material: rigid mineral fibre insulation to CAN/CGSB-51.10.
   .2 "k" Value: maximum 0.038 W/m.°C at 24°C mean temperature.
   .3 Service Temperature: 20°C to 65°C.
   .4 Jacket: factory applied reinforced aluminum foil vapour barrier to CGSB 51-GP-52Ma.
2.3 **Acoustic Ductwork Insulation**

.1 Material: rigid mineral fibre acoustical insulation to ASTM C1071, Type 2.

.2 Density: 48 kg/m³ (minimum).

.3 Acoustic Properties: minimum NRC of 0.70 for 25 mm thickness based on Type A mounting to ASTM C423.

.4 "k" Value: maximum 0.035 W/m°C at 24°C mean temperature when tested in accordance with ASTM C177.

.5 Service Temperature: -40°C to 65°C.

.6 Surface Finish: air stream side coated to prevent fibre erosion with surface roughness not exceeding 0.58 mm.

2.4 **Accessories**

.1 FSK Tape: vapour barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self-adhesive.

.2 ASJ Tape: vapour resistant tape consisting of all service jacket material with pressure sensitive self-adhesive.

.3 Contact Adhesive: quick setting, adhesive to adhere flexible or rigid mineral fibre insulation to ducts.

.4 Lap Seal Adhesive: quick setting adhesive for joints and lap sealing of vapour barriers.

.5 Pins: welding pins 4 mm diameter shaft with 35 mm diameter head for installation through the insulation. Length to suit thickness of insulation with 32 mm square nylon retaining clips.

3.0 **EXECUTION**

3.1 **Installation, General**

.1 Ductwork dimensions shown on drawings are clear inside free area measurement regardless of insulation placement or thickness. Fabricate ducts accordingly.

.2 Apply insulation after required duct system tests have been completed.

.3 Ensure duct surfaces are clean and dry before installing insulation.

.4 Install insulation over entire surface of duct, for full length of duct run including portions of duct passing penetrations through walls and floors.
.5 Install insulation in a manner to insure hangers and standing duct seams do not penetrate insulation.

.6 Locate finished seams in least visible location.

.7 Do not insulate ductwork with external thermal insulation where acoustic duct insulation has been specified.

.8 Install insulation at ambient temperatures within acceptable temperature ratings for tapes, sealants and adhesives.

3.2 Hot Duct Insulation Application

.1 Adhere insulation to round and oval ductwork with contact adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside with wire until adhesive has set.

.2 Butt insulation and seal joints with lap seal adhesive; cover joint ASJ tape.

.3 Secure rigid insulation on rectangular ducts with 50% area coverage using contact adhesive, impale on pins located 400 mm on centre, secure in place with retaining clips.

.4 Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two (2) coats of lap seal adhesive.

3.3 Cold Duct Insulation Application

.1 Adhere mineral fibre insulation to round and oval ductwork with adhesive applied in 150 mm wide strips on 400 mm centres. Band on outside until mastic sets then remove bands.

.2 Butt mineral fibre insulation and seal joints with lap seal adhesive; cover joint with FSK tape.

.3 Secure rigid insulation on rectangular ducts with 50% area coverage of adhesive and impale on pins located 400 mm on centre and secure in place with the retaining clips.

.4 Butt rigid insulation on rectangular ducts and seal joints with lap seal adhesive; cover joints with 100 mm strips of open mesh cloth imbedded between two coats of lap seal adhesive.
3.4 Acoustic Duct Insulation Application

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Install in accordance with manufacturer’s recommendations, and as follows:

.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

.2 In addition to adhesive, install weld pins not less than two (2) rows per surface and not more than 425 mm on centres.

.3 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer’s written recommendations, and as follows:

.1 Bed tape in sealer.

.2 Apply two (2) coats of sealer over tape.

.4 Replace damaged areas of liner at discretion of the Engineer.

.5 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

3.5 Existing Duct Thermal Insulation

.1 Provide for repair and refurbishment of all damaged or discontinuous existing low and medium pressure supply ducts supply duct insulation located in the ceiling spaces in basement renovation.

.2 Repair and secure existing insulation where possible.

.3 Where insulation cannot be secured or repaired, replace with new insulation. Match existing insulation thickness.

3.6 Insulation Schedule

<table>
<thead>
<tr>
<th>Service</th>
<th>Type</th>
<th>Insulation Thickness (Inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Pressure Supply Air Duct</td>
<td>Acoustic</td>
<td>1 (Refer to Plan)</td>
</tr>
<tr>
<td>Low Pressure Return Air Duct</td>
<td>Acoustic</td>
<td>1 (Refer to Plan)</td>
</tr>
<tr>
<td>Low Pressure Supply Air Duct</td>
<td>Cold/Hot</td>
<td>1</td>
</tr>
<tr>
<td>Low Pressure Return Air Duct</td>
<td>Cold/Hot</td>
<td>1</td>
</tr>
<tr>
<td>Medium Pressure Supply</td>
<td>Cold/Hot</td>
<td>1</td>
</tr>
<tr>
<td>Low Pressure Duct (Damaged or discontinuous)</td>
<td>Cold/Hot</td>
<td>To match existing</td>
</tr>
<tr>
<td>Medium Pressure Duct (Damaged or discontinuous)</td>
<td>Cold/Hot</td>
<td>To match existing</td>
</tr>
</tbody>
</table>
1.0 GENERAL

1.1 Scope

.1 Provide all materials and service defined in the Contract Documents that are required to furnish a complete and fully operational Building Automation System (BAS) to monitor and control the building HVAC systems.

1.2 Related Work Specified in Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05
.3 Electric and Electronic Control Systems Section 20 30 33

2.0 PRODUCTS

2.1 General

.1 Supply all materials, equipment and accessories that meet the requirements of the sections listed in Article 1.2.

3.0 EXECUTION

3.1 General

.1 Install, test, adjust and document the HVAC controls work as defined in the sections listed in Article 1.2.

END OF SECTION
1.0 GENERAL

1.1 Related Requirements

.1 General Provisions HVAC Section 23 05 01

1.2 Related Work Specified in Other Sections

.1 Piping and Equipment Insulation Section 20 20 30
.2 Pipe and Pipe Fittings Section 20 20 10
.3 Mechanical Vibration Control Section 23 05 48
.4 Controls Division 26
.5 Connections to Mechanical Equipment Division 26

1.3 Shop Drawings and Product Data

.1 Comply with requirements of Section 01 33 00.

1.4 Quality Assurance

.1 Systems shall be installed by skilled tradesmen with certificates of proficiency as refrigeration mechanics.

.2 Comply with applicable codes, laws and regulations. Conform to CSA-B52, Code for Mechanical Refrigeration; and CSA-B31.5, Code for Refrigerant Piping.

.3 Comply with requirements of the “Quality Control Procedure” prepared by the Refrigeration, Air Conditioning Contractors Association of Alberta, as approved by the Department of Labour, Boiler and Pressure Vessels Branch.

.4 Piping to ANSI B31.1.

2.0 PRODUCTS

2.1 Assembly

.1 Provide for a complete and fully operational refrigerant R-410A direct expansion refrigeration system.

.2 Refrigerant piping arrangement shall ensure:

.1 Compressor oil and liquid refrigerant return to the compressor under load without harm to compressor.
.2 Minimum pressure drops.
.3 Restricted refrigerant migration during the inoperative cycle.
.4 Accessories and piping prevent excessive compressor cycling.
.5 Pipe routing and isolation avoid line breakage, excessive vibration and sound transmission to conditioned space.
.6 Maintenance of clean and dry system.
.7 3-valve bypass on head pressure controls, filter dryers, etc. to allow component service and replacement without blowing the charge.

.3 Provide for proper operation of safety controls and automatic controls not provided by others.

2.2 Refrigerant Piping and Accessories

.1 Piping shall be bright annealed refrigerant Grade ACR copper manufactured in accordance with ASME Standards.

.2 Make joints with brazed copper to copper couplings. Fittings shall be wrought type. Do not use cast fittings.

.3 Shut-off valves shall be refrigeration grade angle, globe and ball type.

.4 Silver brazed joints using copper-phosphorous alloy with melting point between 600°C and 800°C using current quality control procedures.

.5 Provide liquid suction intercoolers when required to compensate for excessive liquid line pressure drop.

.6 Provide combination moisture and liquid indicator located in liquid line leaving receiver and on leaving side of liquid solenoid valve on multiple coil installation. Indicator shall be full line size, double lens type and have seal caps.

.7 Provide combination filter-drier sized for full capacity of system. Driers shall have replaceable cores on systems with liquid lines larger than 16 mm.

.8 Install solenoid valves on liquid lines to DX evaporator coil. Valve shall have manual lifting stem in case of solenoid coil failure.

.9 Provide valved refrigerant charging connection on liquid line from receiver.

.10 Provide expansion valves.

.11 Provide safety valves sized according to Code.

.12 Provide service valves on suction and discharge of compressors.

2.3 Insulation

.1 Insulate suction lines throughout. At hanger locations, provide 150 mm long curved metal plate to protect insulation.
3.0 EXECUTION

3.1 Refrigerant Piping

.1 Size piping for minimum pressure drops in system. Maximum temperature drop in systems to be 1.0°C for suction, hot gas and for liquid line. Pipe sizing shall be in accordance with latest ASHRAE Standards.

.2 Arrange piping to return oil to compressor. Under minimum load conditions, gas velocity must not be less than 2.5 m/s through horizontal lines and 5 m/s through vertical lines. Pitch horizontal lines minimum of 1:250 in direction of refrigerant flow. Provide traps in piping systems as required and keep horizontal dimensions of traps as small as possible. Use double risers as required to obtain proper velocity in vertical risers.

.3 Attach hangers and supports to solid surface within one metre from each change of direction, isolated when necessary to prevent noise transmissions to structure.

.4 Provide staged oil traps where evaporator is below the compressor. Maximum oil lift in one stage shall be 8 metres.

.5 Clean and dehydrate system with vacuum pump. Do not use compressor. Pressure test piping before charging with refrigerant. During the brazing process, bleed nitrogen gas through the pipe to prevent scale and corrosion.

.6 Where applicable friction drop or static head due to elevations on liquid line is present, provide additional means for liquid sub-cooling to prevent flashing.

.7 Arrange piping loops in evaporator suction lines to prevent liquid refrigerant from draining into the compressor during shut down and prevent oil in an active evaporator from draining into an idle evaporator.

.8 Arrange piping to prevent compressors or condenser vibrations from being transmitted to piping. Run discharge lines at least 10 pipe diameters in each of three directions before first point of support, or provide flexible connectors.

3.2 Testing, Dehydration, Charging and Start-Up

.1 At completion of installation, pressurize system with nitrogen and refrigerant and check for refrigerant leaks. Repair leaks and re-test. Dehydrate system and charge with refrigerant. Start-up system and check out operation.

.2 Carry out check out using detailed check sheets. Include completed and signed check lists in operating and maintenance manuals.

.3 If installation is completed in winter season, pump down refrigerant and repeat procedure at start of next cooling season.

.4 Provide completed documentation for proper operation and maintenance of systems. Provide on-site instruction period for Owner's personnel with Consultant's representative.
3.3 Start-Up

.1 Arrange and pay for manufacturer's personnel to complete check out list, charge system and supervise start-up. Record refrigerant pressures, operating voltage and amp draws, under full load/part load conditions and submit report to Consultant.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Ductwork and plenums.
.2 Fasteners.
.3 Sealants.
.4 Connection / integration of ductwork to equipment, louvres, plenums, dampers, flexible ducts, terminal boxes, air outlets and other similar accessories.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions                  Section 20 05 01
   .2 General Documentation                           Section 20 05 05
   .3 Materials Testing                                Section 20 05 07
   .4 Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors Section 20 05 29
   .5 Testing, Balancing and Adjusting                 Section 20 22 00

   .2 Duct Insulation                                  Section 23 07 13

   .3 Air Duct Accessories                             Section 23 33 13

   .4 Air Outlets and Inlets                           Section 23 37 13

1.3 Definitions

.1 Low Pressure: Static pressure in duct less than 2 in WG and velocities less than 2000 fpm.
.2 Medium Pressure: Static pressure in duct less than 6 in WG and velocities greater than 2000 fpm.
.3 High Pressure: Static pressure over 6 in WG and less than 10 in WG and velocities greater than 2000 fpm.
.4 Duct sizes shown on plans are inside clear dimensions. For acoustically lined or internally insulated ducts, maintain sizes inside ducts.
1.4 Reference Documents

.1 American Society for Testing and Materials (ASTM):
   .1 ASTM A653/A653M-09 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process

.2 National Fire Protection Association (NFPA):
   .1 NFPA 90A Standard for the Installation of Air Conditioning and Ventilation Systems
   .2 NFPA 90B Standard for the Installation of Warm Air Heating and Air Conditioning Systems


.4 South Coast Air Quality Management District, California State (SCAQMD):
   .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

1.5 Quality Assurance

.1 Ductwork shall meet the requirements of NFPA No. 90A - Air Conditioning and Ventilating Systems; NFPA No. 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.2 Fabricate in accordance with the most stringent requirement of SMACNA duct manuals and ASHRAE handbooks as a minimum, unless more stringent requirements are not identified in the contract documents. Straight tap fittings and dovetail joints are not permitted.

1.6 Alternatives

.1 Obtain written permission from the Mechanical Consultant prior to making variations in duct configuration or sizes. Size alternatives using ASHRAE table for circular equivalents of rectangular ducts.
2.0 PRODUCTS

2.1 Materials

.1 Ducts: Galvanized steel lock forming quality, having galvanized coating of 0.078 lb/ft² to ASTM A653M-G90 designation for both sides.

.2 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts. Weld kitchen exhaust ducts.

.3 Sealant: Water resistant, fire resistive, compatible with mating materials meeting Rule 1178, Adhesive and Sealant Applications, South Coast Air Quality Management District, California State (SCAQMD).

2.2 Low Pressure Duct Thicknesses (Minimum)

.1 Rectangular Ducts

<table>
<thead>
<tr>
<th>Maximum Width</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 300 mm</td>
<td>0.6</td>
</tr>
<tr>
<td>330 mm to 760 mm</td>
<td>0.8</td>
</tr>
<tr>
<td>790 mm to 1370 mm</td>
<td>0.8</td>
</tr>
<tr>
<td>1400 mm to 2130 mm</td>
<td>1.0</td>
</tr>
<tr>
<td>2160 mm and Over</td>
<td>1.2</td>
</tr>
</tbody>
</table>

.2 Round Ducts

<table>
<thead>
<tr>
<th>Duct Diameter</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 330 mm</td>
<td>0.6</td>
</tr>
<tr>
<td>350 mm to 550 mm</td>
<td>0.8</td>
</tr>
<tr>
<td>580 mm to 1270 mm</td>
<td>0.8</td>
</tr>
<tr>
<td>890 mm to 910 mm</td>
<td>1.0</td>
</tr>
<tr>
<td>1300 mm to 1520 mm</td>
<td>1.2</td>
</tr>
<tr>
<td>1550 mm to 2130 mm</td>
<td>1.6</td>
</tr>
</tbody>
</table>

2.3 Medium Pressure Duct Thickness

.1 Rectangular Ductwork:

<table>
<thead>
<tr>
<th>Maximum</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 460 mm</td>
<td>0.8</td>
</tr>
<tr>
<td>480 mm to 1220 mm</td>
<td>0.8</td>
</tr>
<tr>
<td>1250 mm to 1830 mm</td>
<td>1.0</td>
</tr>
<tr>
<td>1850 mm to 2440 mm</td>
<td>1.2</td>
</tr>
<tr>
<td>2460 mm and Over</td>
<td>1.6</td>
</tr>
</tbody>
</table>
2.4 **Medium & High Pressure Duct Thicknesses**

<table>
<thead>
<tr>
<th>Round Ducts</th>
<th>Spiral Lock Seam mm</th>
<th>Longitudinal Seam mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 200 mm</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>230 to 560 mm</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>580 to 910 mm</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>940 to 1270 mm</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1300 to 1520 mm</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>1550 mm and Over</td>
<td>1.6</td>
<td>0.6</td>
</tr>
</tbody>
</table>

2.5 **Oval Ductwork (Factory Made With Spiral Lock Seams)**

<table>
<thead>
<tr>
<th>Maximum Width</th>
<th>mm</th>
<th>Centers</th>
<th>Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 500 mm</td>
<td>0.8</td>
<td>1220 mm</td>
<td>L50 x 50 x 3 mm</td>
</tr>
<tr>
<td>280 to 500 mm</td>
<td>0.8</td>
<td>760 mm</td>
<td>L50 x 50 x 5 mm</td>
</tr>
<tr>
<td>530 to 1020 mm</td>
<td>1.2</td>
<td>600 mm</td>
<td>L75 x 75 x 5 mm</td>
</tr>
<tr>
<td>1040 to 1830 mm</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.6 **Fabrication**

.1 Complete metal ducts with themselves with no single partition between ducts. Where width of duct exceeds 450 mm cross break for rigidity. Open corners are not acceptable.

.2 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.3 Construct tees, bends, and elbows with radius of not less than 1 1/2 times width of duct on centre line. Where not possible and where rectangular elbows used, provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibreglass inside.

.4 Increase duct sizes gradually, not exceeding 15 degree divergence wherever possible. Maximum divergence upstream of equipment to be 30 degree and 45 degree convergence downstream.

.5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.6 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.
.7 Fabricate continuously welded medium and high pressure round and oval duct fittings of one gauge heavier than gauges indicated for duct size. Joints shall be 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints. Fabricate elbows of five piece construction. Provide standard 45° take-offs unless otherwise indicated where conical 90° tee take-off connections may be used. Adequately brace with truss couplings or comparison angle flanges with gaskets bolted at 150 mm centers.

### 3.0 EXECUTION

### 3.1 Duct Sealing

.1 All supply, return and exhaust duct joints, longitudinal as well as transverse, shall be sealed using:

.1 Low Pressure Ductwork:

.1 Slip Joints: Apply heavy brush-on high pressure duct sealant. Apply second application after the first application has completely dried out. Where metal clearance exceeds 16 gauge use heavy mastic type sealant.

.2 Flanged Joints: Soft elastomer butyl or extruded form of sealant between flanges followed by an application of heavy brush-on high pressure duct sealant.

.3 Other Joints: Heavy mastic type sealant.

.2 Medium Pressure Ductwork: Combination of woven fabrics and sealing compound followed by an application of high pressure duct sealant.

.2 Duct tapes as sealing method are not permitted.

.3 Surfaces to receive sealant should be free from oil, dust, dirt, moisture, rust and other substances that inhibit or prevent bonding.

.4 Prior to sealing all ductwork, demonstrate sealing of a section of each type of duct and obtain approval from the engineer.

.5 Do not insulate any section of the ductwork until it has been inspected and approved of duct sealant application.
3.2 Installation

.1 Locate ducts with sufficient space around equipment to allow normal operation and maintenance activities.

.2 Coordinate the location of duct access doors. Refer to Section 20 05 29 - Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors.

.3 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.4 Shield ductwork from dust and construction material during construction. Clean any ductwork found to be dirty at no extra cost to the Contract.

.5 Do not use flexible duct to change direction. Provide a minimum of five (5) duct diameters of straight metal duct between box inlet and flexible connector.

.6 Prove that ductwork is substantially air tight before covering or concealing.

.7 Fabricate ductwork from field measurements and not from plans and shop drawings exclusively. Failure to do so will not constitute an extra to the Contract.

END OF SECTION
1.0  A GENERAL

1.1  Scope

.1  Clean supply / exhaust / return ductwork systems and plenums.

.2  Clean all terminal boxes and reheat coils.

.3  Supply and install access doors where required to facilitate ductwork cleaning.

1.2  Related Work Specified In Other Sections

.1  Refer to and comply with the following sections:

.1  General Mechanical Provisions  Section 20 05 01
.2  General Documentation  Section 20 05 05
.3  Metal Ducts  Section 23 31 13
.4  Air Duct Accessories  Section 23 33 13

1.3  Quality Assurance

.1  The HVAC system cleaning sub-trade shall be a certified member of the National Air Duct Cleaners Association (NADCA) or equivalent.

.2  The Owner may hire an independent agency to review duct cleaning procedures prior to starting work and perform spot checks to confirm that duct system cleaning has been effectively executed.

.3  Submit a letter certifying that all systems have been completely cleaned and are ready for inspection.

.4  Acceptable contractors: Don’s Pow-R Vac, Carson Pow-R-Vac, Modern Power Vac.

1.4  Submittals

.1  Submit certification of NADCA membership.

.2  Submit list of five (5) recent projects of similar magnitude.

.3  Submit the name of the superintendent-in-charge of the work and list his project experience.

.4  Submit an outline of the work scope for each ductwork system, lighting procedures, equipment, materials and schedule, prior to starting work.

.5  Submit a certificate of completion for each ductwork system that cleaning has been completed as defined in the specifications.
1.5 Definitions

.1 Level 1 Clean: No visible particulates or deposition after vacuum techniques have been completed.

.2 Level 2 Clean: "White glove" clean, ductwork to be wiped clean with de-ionized water. Wipe down interior of ductwork in room downstream of supply air terminals, including all low velocity ductwork.

.3 Air System: Includes central equipment; supply, return, exhaust fans, coils, dampers, turning vanes, grilles, diffusers, high, medium and low pressure ductwork (supply, return and exhaust) that is associated with an air handling system.

2.0 PRODUCTS

2.1 Materials

.1 Access Doors: Minimum 450 mm x 350 mm door, hinge and frame type, positive latching/locking mechanism. Refer to Section 23 33 13 - Air Duct Accessories.

.2 Cleaning Equipment: 5.0 kPa suction capacity and 12,000 L/s minimum capacity.

.3 Temporary Filters: 3 ply filter element with 35% ASHRAE 52-76 dust spot efficiency of 2.64 m/s face velocity to protect equipment during cleaning operation.

.4 Cleaning Agent:

   .1 Safeguard
   .2 Microban

3.0 EXECUTION

3.1 General

.1 Perform HVAC system cleaning in accordance with the current published standards of NADCA.

3.2 Preparation

.1 Isolate items to be cleaned so as not to contaminate unprotected work.

.2 Equip vacuum equipment with filters.
3.3 Installing Access Doors

.1 Locate access doors and install as follows:

.1 At 12.0 m intervals in vertical ducts.
.2 Horizontal ducts at intervals of 6 m.
.3 At the base of all duct risers.
.4 Both sides of turning vanes in all ducts.
.5 At each fire damper location.
.6 At each side of all coils except where an access is provided.
.7 At all locations of internally duct mounted equipment or devices including balancing dampers, automatic dampers, damper motors, duct mounted smoke detectors and heat detectors, and controls, except where access is provided.
.8 Where required to facilitate duct cleaning.

3.4 Duct System Cleaning

.1 Commence Level 1 Standard cleaning after completion of duct system installation and before connection to existing air handling system. Provide at completion of each phase of work.

.2 Following completion of Level 1 cleaning procedures, clean the following duct systems to Level 2 standard:

.1 All ductwork downstream of any new or modified ductwork.
.2 Downstream of any VAV box in emergency area.

.3 Install filters as follows:

.1 Behind all grilles and diffusers.
.2 In front of all duct coils.
.3 At inlet of all terminal high velocity units to protect pitot openings.

.4 When the duct systems are completed and before any fan systems are operated, clean all ductwork, plenums, coils and air handling equipment by compressed air and mechanical equipment or compressed air and high power suction equipment.

.5 Do not use mechanical brushes on acoustic lined ductwork.

.6 Remove all filters within five (5) days after vacuum procedures is completed. Ensure the number of filters removed is equal to the number of filters installed.

.7 Seal all ductwork outlets and plenum openings with polyethylene sheet cover after ductwork has been cleaned.
3.5 Quality Assurance And Verification

.1 The HVAC system will be visually inspected to confirm no visual contaminants are present. If visible contaminants are evident, those portions of the system shall be re-cleaned and re-inspected.

.2 Submit a report to the engineer confirming that the HVAC system and its components have been successfully cleaned and verified by visual inspection and that any parts of the HVAC system damaged by this work have been identified and corrective measures have been undertaken.

.3 Repeat duct cleaning procedures on all sections found not satisfactory by independent test agency hired by the Owner.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Access doors (duct access and plenum access).

.2 Balancing dampers.

.3 Flexible connections to equipment.

.4 Sealants.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01
.2 General Documentation Section 20 05 05

.2 Metal Ducts Section 23 31 13

.3 Air Outlets and Inlets Section 23 37 13

1.3 Quality Assurance

.1 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems. Fabricate in accordance with SMACNA Duct Manuals.

.2 Flexible air duct shall comply with NFPA 90A and UL181 Standard for Factory-Made Air Ducts and Air Connectors.

1.4 Submittals

.1 Submit shop drawings of factory fabricated assemblies.

.2 Submit samples of shop fabricated assemblies as requested by the Engineer.

.3 Comply with requirements of Section 20 05 05 - Documentation.

2.0 PRODUCTS

2.1 Acceptable Manufacturers

.1 Access Doors : Acudor, Hilcor, Controlled Air, Air-O-Metal, Titus, Ductmate.

.2 Sealants : Ductmate.
2.2 **Duct Access Doors**

.1 Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and suitable quick fastening locking devices. Duct access panels with screws are not acceptable. Install minimum 1” thick insulation with suitable sheet metal cover frame for insulated ductwork.

.2 Fabricated with two butt hinges and two sash locks for sizes up to 18”, two hinges and two compression latches with outside and inside handles for sizes up to 24” x 48” and an additional hinge for larger sizes.

2.3 **Balancing Dampers**

.1 Fabricate of galvanized steel, minimum 16 gauge. Full blade-length shafts of hollow square construction with blades rigidly fastened along entire blade length.

.2 Lockable quadrant type operating mechanism with end bearings on accessible rectangular ducts up to 16” deep and on accessible round ducts.

.3 Wide pitch screw operating mechanism with crank operator and end bearings on accessible rectangular ducts 17” and over in depth and on all inaccessible rectangular and round ducts.

.4 On rectangular ducts up to 11” deep construct of single blade (butterfly) type.

.5 On rectangular ducts 12” x 16” deep construct of two opposed blades mechanically interlocked with pivots at quarter points.

.6 On rectangular ducts over 17” deep construct of multiple opposed blades, mechanically interlocked with blades no greater than 8” deep and pivots equally spaced.

.7 On round ducts construct of single blade (butterfly) type. On 2 in WG class and on all dampers over 12” diameter fabricate with full blade-length shaft.

.8 Construct damper blades for medium and high pressure systems to block air passage 70% maximum. Provide complete with locking type handles.

.9 Provide over-ride limiting stops on all operating mechanisms.

.10 Identify the air flow direction and blade rotation and open and close positions on operating mechanism.

.11 On round ductwork, install operating mechanism on a steel mounted base firmly secured to the ductwork.

.12 On externally insulated ductwork, install operating mechanisms on a steel bridge type mounting base to permit continuity of insulation under the mechanism.
2.4 Flexible Duct Connections To Air Outlets

.1 Perforated aluminum flexible metal core with 20%-25% opening area. Enclosed with 1" thick glass fibre insulating wood with minimum density of 3/4 lb. and compressed to 25% minimum. Triple lock aluminum flexible ducting.

.2 Operating Temperature Range: 40°F to 400°F.

.3 Operating Pressure: Maximum 12" static.

.4 Products: Flexmaster.

2.5 Sealants

.1 Comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.

.2 Sealants to contain zero VOC and comply with LEED cr4.1 – Requirements for Low Emitting Materials.

3.0 EXECUTION

3.1 Application

.1 Duct Access Doors

   .1 Provide access door minimum 18" x 14" or 2" smaller than duct dimension for cleaning and inspection at positions indicated by drawings and as follows:

      .1 At each side of VAV boxes to access the damper.
      .2 At each side of VAV inlet to access the pressure sensor.

3.2 Balancing Dampers

.1 Install balancing dampers at all branch ducts on low pressure supply, return and exhaust air distribution ductwork and where indicated on drawings.

.2 Provide single blade dampers for duct sizes to 240 mm x 760 mm. Provide multi-blade opposed blade dampers with maximum blade size at 150 mm x 1800 mm.

3.3 Flexible Duct Connections To Air Outlets

.1 Install maximum 4' length of flexible duct between ceiling diffuser and sheet metal duct with one 90° bend in between.
1.0 GENERAL

1.1 Scope

.1 Pressure independent variable volume regulators complete with damper motor operator suitable for supply air and return air application silencer.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

   .1 General Mechanical Provisions Section 20 05 01
   .2 General Documentation Section 20 05 05
   .3 Testing, Balancing and Adjusting Section 20 22 00
   .4 Duct Insulation Section 23 07 13
   .5 Air Duct Accessories Section 23 33 13

1.3 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience.

.2 Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

.3 The terminal units shall be tested and certified in accordance ASHRAE 130-1996.

.4 Insulation materials, coatings, vapour barrier facings, tapes and adhesives: Composite fire and smoke hazard rating shall not exceed 25 for flame spread and 50 for smoke developed in accordance with Alberta Building Code.

.5 Terminal Performance and Silencer Assembly AHRI certified.

.6 Factory assembled, test and calibrate all components to form a complete unit.

1.4 Labelling

.1 Label units with capacities as factory adjusted including minimum maximum ratings of volume regulators, complete with naming tag consistent with schedule.

1.5 Performance Criteria

.1 At inlet velocity of 2000 feet per minute, pressure loss across the assembly shall not exceed 0.4 inches S.P.

.2 Casing leakage shall not exceed 2% design flow at rated internal pressure.
2.0 PRODUCTS

2.1 Approved Equals

.1 E.H. Price, Titus.

2.2 Construction

.1 Fabricate terminal casing with 22 gauge galvanized steel. Line casing with 1” thick 1.5 lb density minimum, neoprene or vinyl coated fibrous glass acoustic insulation in compliance with UL-181, ASTM C1071 and NFPA 90A.

.2 Fabricate silencer section using 22 gauge solid galvanized metal casing, 22 gauge perforated galvanized metal lining and absorptive fiberglass liner.

.3 Construct air valve damper from heavy galvanized steel with peripheral gasket and solid steel shaft, pivoted in self-lubricating bearings.

.4 Utilize a cross configuration air flow sensor at the inlet of the assembly, with minimum twelve (12) pressure sensing ports and centre averaging chamber, providing ±5% accuracy when tested with a 90° elbow directly at the inlet of the assembly.

.5 Reset volume with damper operator attached to assembly allowing flow range modulation from maximum to minimum specified.

3.0 EXECUTION

3.1 Installation

.1 Arrange for suitable ceiling access to units. Provide access doors or locate above easily removable ceiling components.

.2 Install units individually from the structure. Do not support from adjacent ductwork.

.3 Provide a minimum of five inlet diameters of straight duct at inlet of units. Do not use flexible duct connections on inlet or discharge from the assembly.

3.2 Performance

.1 Refer to schedule on drawings for performance data.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Diffusers.

.2 Grilles and Registers.

1.2 Related Work Specified In Other Sections

.1 Refer to and comply with the following sections:

.1 General Mechanical Provisions Section 20 05 01

.2 General Documentation Section 20 05 05

.3 Testing, Balancing and Adjusting Section 20 22 00

.4 Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors Section 20 05 29

.5 Duct Accessories Section 23 33 13

1.3 Quality Assurance

.1 Air flow tests and sound level measurement shall be made in accordance with applicable ADC equipment test codes, ASHRAE Standards and AMCA Standards.

.2 Unit rating shall be approved by ADC and AMCA.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

1.4 Job Conditions

.1 Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlets.

.2 Positions indicated are approximate only. Confirm locations of outlets and make necessary adjustments in position to conform with Architectural features, mounting requirements, symmetry and lighting arrangement.

1.5 Submittals

.1 Submit shop drawings with complete catalogue information, materials of construction, dimensions and accessories. Comply with Section 20 05 05 - General Documentation.

.2 Submit colour selection charts of finishes, for approval prior to fabrication.

.3 Comply with requirements of Section 20 05 05 - General Documentation.
2.0 PRODUCTS

2.1 Acceptable Manufacturers

.1 Diffusers : Price, Titus.

.2 Grilles and Registers : Price, Titus.

2.2 General

.1 Base air outlet application on space noise level of NC 30 maximum.

.2 Provide supply outlets with sponge rubber seal around the edge.

.3 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

.4 Provide plaster frame for diffusers located in plaster surfaces.

.5 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.6 Refer to Air Outlet Schedule for specifications of air outlets.

3.0 EXECUTION

3.1 Installation

.1 Make airtight connection between diffusers and ductwork.

.2 Provide balancing damper on duct take-off to each diffuser at main branch take-off, even when volume dampers are specified as part of grille assembly.

.3 Sizes indicated are nominal. Provide correct standard product nearest to nominal to deliver the capacity listed without increasing noise levels or pressure drop.

.4 Adjust supply outlets to deliver air patterns defined on drawings or as directed by the Engineer.

.5 Provide smudge resistant frames on diffusers located on textured ceilings.

3.2 Air Inlet/Outlet Schedule

.1 Refer to schedule on drawings.

END OF SECTION
1.0 GENERAL

1.1 Scope

.1 Room air conditioner.

.2 Remote Condensing Unit.

.3 Refrigerant.

.4 Controls.

1.2 Quality Assurance

.1 Provide factory assembled, package type unitary air conditioning unit, product of manufacturer regularly engaged in production of unit of type and size specified, who issues complete catalogue data on such products. Unit shall be factory built and tested.

.2 Manufacturer shall be responsible for selection and operation of components furnished by him. Provide written certification that components not furnished by him have been selected in accordance with his requirements.

.3 Unit shall be factory built and tested.

.4 Unit shall be CSA approved and listed.

.5 The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

.6 The units shall be rated in accordance with ARI Standard 210 and bear the ARI label.

.7 The outdoor unit shall be pre-charged for 70 feet of refrigerant tubing.

.8 Helium holding charge shall be provided in the evaporator.

.9 System efficiency shall meet or exceed 13.0 SEER.

1.3 Warranty

.1 The units shall have a manufacturer’s warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of six (6) years from date of installation. If during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
1.4 Submittals

.1 Shop drawings shall include: Single line diagrams; Dimensional; Electrical and capacity data; Piping and electrical connection drawings.

.2 Comply with the requirements of Section 01 33 00 - Submittals.

2.0 PRODUCTS

2.1 Acceptable Manufacturer

.1 Mitsubishi.

2.2 Refrigerant

.1 The system shall use R410A refrigerant.

2.3 Indoor Unit

.1 The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the remote controller shall have a self-diagnostic function, three (3) minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit refrigerant pipes will be charged with helium air before shipment from the factory.

.2 Unit Cabinet

.1 The casing shall be ABS plastic and have a munsell 3.4Y 7.7/0.8 finish. Multi-directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard. There shall be a separate back plate which secures the unit firmly to the wall.

.3 Fans

.1 The evaporator fan shall have a line flow fan driven by a single motor. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. Manual adjustable louvers shall be provided to laterally change direction of airflow. A motorized vane shall close the outlet port when operation is stopped. It shall also automatically direct air flow in a vertical direction for uniform air distribution. The indoor fan shall consist of two (2) speeds, Hi and Low.

.4 Filter

.1 Return air shall be filtered by means of an easily removed washable filter.
.5 Coil

.1 The evaporator coil shall be of nonferrous construction with aluminum strake pre-coated fins on copper tubing. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

.6 Electrical

.1 The unit electrical power shall be 208 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The unit shall have an optional, shared power supply between indoor and outdoor units or individual power supply.

.7 Control

.1 This unit shall have a wired controller to perform input functions necessary to operate the system. The wire controller shall have multi-language, a large DOT liquid crystal display and a weekly timer with eight pattern settings per day. The controller shall consist of an On-Off switch, Cool/Dry-Fan selector, Thermostat setting, Timer Mode, High-Low fan speed, Auto Vane selector, Test Run switching and Check Mode switching. The controller shall have a built in temperature sensor. Temperature changes shall be by 1°F increments with a range of 19-30°C (67-87°F). Temperature displayed in both °F and °C. The control system shall consist of two (2) microprocessors interconnected by a single non-polar two wire cable.

.2 Normal operation of the remote controller provides individual system control in which one remote controller and one indoor unit are installed in the same room.

.3 The controller shall have the capability of controlling up to a maximum of sixteen (16) systems at a maximum developed control cable distance of 457 meters (1,500 feet).

.4 Field wiring shall run direct from the indoor unit to the controller with no splices. Manufacturer shall provide two (2) conductor non-polar 22 AWG stranded wire for connection to remote controller.

.5 The system shall include self-diagnostics including total hours of compressor run time., Diagnostics codes for indoor and outdoor unit shall be displayed on wired remote panel. Controller shall display operating conditions such as pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions, including (running current, frequency, input voltage, on/off status and operating time), LEV opening pulses sub cooling and discharge super heat.
.6 The microprocessor within the wall mounted remote controller shall provide automatic cooling, display set point and room temperature. Control system shall control the continued operation of the air sweep louvers, as well as provide on/off and system/mode function switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay. Two remote controllers can be used to control one unit.

.7 The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit. The control voltage from the controller to the indoor unit shall be 12 volts DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. The system shall be capable of automatic restart when power is restored after power interruption.

.8 The unit shall be controlled by building management system. Unit to provide interface device to communicate with BACnet system.

2.4 Outdoor Unit

.1 The outdoor unit must be of the same capacity as the indoor unit. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all functions necessary for operation. The outdoor unit shall contain Variable Compressor Speed inverter Technology. The outdoor unit shall be capable of operating at -40°C (-40°F) low ambient temperature controls (optional wind baffle may be required). The outdoor unit must have the ability to operate with a maximum height difference of 30.5 meters (100 feet) and have a maximum refrigerant tubing length of 50.3 meters (165 feet). Each unit must be test run at the factory.

.2 The outdoor unit shall be shipped re-charged with refrigerant.

.3 Cabinet

.1 The casing shall be constructed from galvanized steel plate and finished with acrylic paint munsell 3Y 7.8/1.1. The fan grille shall be of ABS plastic.

.4 Fan

.1 The motor bearing shall be permanently lubricated. The fan blade shall be aerodynamic design for quiet operation. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispensing it through the front.
.5 Coil

.1 The L shaped condenser coil shall be of copper tubing with flat aluminium fins to reduce debris build up. The coil shall be protected with an integral metal guard.

.2 Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be controlled by a microprocessor controlled step motor.

.6 Compressor (VCSI)

.1 The compressor shall be a rotary compressor with variable compressor speed inverter technology (VSCI). The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall match the room load to significantly increase the efficiency of the system which results in vast energy savings. During the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor, to maintain enough heat to prevent liquid from accumulating in the compressor. The outdoor unit shall have an accumulator and high pressure safety switch.

.7 Electrical

.1 The unit electrical power shall be 208 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have pulse amplitude modulation circuit, this shall enable the unit to use 98% of input power supply.

.8 Ultra-Low Ambient Package

.1 Ultra-Low Ambient systems are shipped with ultra-low ambient package factor installed.

.2 Each unit is integrated with electronic control systems to provide dependable operation during adverse conditions.

.3 Wind shields are provided separately to protect the unit from prevailing winds.

.4 Ultra-Low Ambient option to allow system to operate down to (-40°F) -40°C in cooling mode.
3.0 EXECUTION

3.1 Installation

.1 Install units in accordance with manufacturer’s installation instructions.

.2 Units to be installed plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

.3 Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish cop of manufacturer’s electrical connection diagram submittal to electrical contractor.

.4 Install and connect devices furnished by manufacturer but not specified to be factory mounted.

.5 Connect condensate drain to air evaporator unit. Unit drain shall be trapped internally.

.6 Start-up air conditioning unit in accordance with manufacturer’s start-up instructions. Test controls and demonstrate compliance with requirements.

3.2 Delivery, Storage And Handling

.1 Unit shall be stored and handled according to the manufacturer's recommendation.

.2 The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity.

3.3 Performance

.1 Performance shall be based on 19.4°C (67°F) WB, 26.7°C (80°F) DB for the indoor unit and 23.9°C (75°F) WB, 35°C (95°F) DB, for the outdoor unit.

.2 Refer to Air Conditioning Unit Schedule on drawings.

END OF SECTION
1.0 GENERAL

1.1 Introduction - Scope of Work

.1 Provide power receptacle in the meeting rooms, training room, test lab, storage and file room, mechanical equipment, conduit rough-ins for data, converters for HDMI, lighting controls and lighting as shown on drawings.

.2 Remove existing lighting. Coordinate power with furniture systems vendor, raised floor and installer. Supply and install new cable tray system under the raised floor for power and data. Supply 6" wide aluminum ladder cable tray for power and 6" wide basket cable tray for data. Data cabling to be supplied and installed by others, E/C to provide conduit and box for data outlet.

.3 Supply and install new grounding conductor for the cable tray as per CEC.

.4 Supply and install new grounding conductor for the raised floor.

.5 Relocate existing fire alarm devices and supply and install new fire alarm devices as shown on drawings.

.6 Relocate existing mass notification devices and supply and install new mass notification devices as shown on drawings.

.7 Supply and install new power, rough-ins for data including cable trays, conduit c/w pull strings, cable TV and HDMI connections for the new TV and computers.

.8 Contractor to attend bi-weekly site meetings. Provide an overall updated project schedule bi-weekly and updated detailed schedule weekly to keep WCB informed. These schedules will aid WCB to inform building occupants of planned power outages. All power shutdowns to be planned with WCB.

1.2 Reference Standards

.1 Within the text of these specifications, reference may be made to the following standards:

CSA - Canadian Standards Association
EEMAC - Electrical and Electronic Manufacturers Association of Canada
CEMA - Canadian Electrical Manufacturers Association
IEEE - Institute of Electrical and Electronic Engineers
IPCEA - Insulated Power Cable Engineers Association
ULC - Underwriters Laboratory of Canada
CEC – Canadian Electrical Code

.2 Electrical materials, products and equipment shall be CSA approved and conform with EEMAC standards. Where necessary, obtain local CSA approval.

.3 Equipment, wiring and wiring devices shall meet the requirements of the Current Edition of the Canadian Electrical Code, Part 1, including all bulletins in force at the time of tender submission.
1.3 Drawings and Specifications

.1 The General Conditions, Supplementary Conditions and Division 01 are a part of this specification and shall apply to this Division.

.2 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.

.3 Symbols used to represent various electrical devices often occupy more space on the drawing than the actual device does when installed. In such instances, do not scale locations of devices from electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.4 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.5 Provide all items and work not shown or specified but which are reasonably necessary to complete the Work.

.6 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, advise WCB for clarification before submitting tender (as per IFB Section 8.1).

1.4 Quality Assurances

.1 Codes, Rules, Permits & Fees

.1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.

.2 Comply with all rules of the Canadian Electrical Code, CSA Standard C22.1 and the applicable building codes.

.3 Quality of work specified and/or shown on the drawings shall not be reduced by the foregoing requirements.

.4 Give all required notices, submit drawings, obtain all permits, licenses and certificates and pay all fees required for this work.

.5 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Engineer.
.2 Standards of Workmanship

.1 Execute all work in a competent manner and to present an acceptable appearance when completed.

.2 Employ a competent supervisor/foreman and a sufficient number of licensed tradesmen to complete the Work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

.5 The Contractor shall, at all times, keep a competent foreman in charge of the work and this foreman shall facilitate the inspection of the work as directed by the Engineer; there shall be no charges for this. The Contractor shall complete his work as quickly as possible, and immediately make any changes or modifications requested by the Engineer during specific or routine inspections in writing.

1.5 Shop Drawings

.1 Within ten (10) days of award of contract, the contractor shall submit a completed equipment procurement schedule which lists the manufacturer and model of equipment, indicating the projected ordering, shop drawing submittal date and delivery dates of all products to meet the required construction schedule.

.2 Prior to delivery of any products to job site and sufficiently in advance of requirements to allow ample time for checking, submit shop drawings for review as specified. Submit shop drawings for all equipment as required in each section of this specification.

.3 Prior to submitting the shop drawings to the Engineer, the Contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings. Contractor shall stamp the shop drawings as "reviewed" prior to submitting them to the Engineer.

.4 The term "shop drawing" means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.

.1 Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.2 Adjustments made on shop drawings by the Engineer are not intended to change the contract price. If adjustments affect the value of the work state such in writing to the Engineer prior to proceeding with the Work.
.5 Manufacture of products shall conform to revised shop drawings.

.6 Keep one (1) complete set of shop drawings at job site during construction.

.7 Submittals shall include:

   .1 Date and revision dates;
   .2 PROJECT TITLE AND NUMBER (MUST appear on ALL copies of ALL shop drawings submitted for approval);
   .3 Applicable name of Contractor, Subcontractor, Supplier, Manufacturer and separate details when pertinent;
   .4 Identification of product or materials;
   .5 Applicable standards, such as CSA or CGSB numbers;
   .6 CONTRACTOR’S STAMP, INITIALED OR SIGNED, certifying to review of submittal, verification of field measurements and compliance with Contract Documents.

1.6 Record Drawings

.1 The Contractor shall keep one complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the Contractor shall clearly record in Red Pencil/Pen all as-built conditions which deviate from the original contract documents. Record drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

.2 The Contractor is to submit as-built drawings to Engineer. Engineer to provide electronic AutoCAD Drawings to WCB. There are no engineering fees required for this work. If the contractor does not submit O&Ms and as-builts, there shall be a $5,000 hold back to the contract at substantial completion of the project.

1.7 Operation And Maintenance Manuals

.1 Within thirty (30) days prior to substantial performance, the Contractor shall submit a draft copy of the proposed contents of each maintenance manual to the Engineer for review. Once the draft copy is approved, the Contractor will supply three (3) copies in suitably labeled, hard back, 216 mm x 280 mm capacity expanding spine catalogue binders bound with heavy fabric binders each complete with an index and tabbed title sheets for each section. Label with letters, hot stamped in gold lettering (front and spine). Electrical Operating and Maintenance Manuals, Electrical Engineering Firm, Contractor’s and Project Name. In addition, submit all information in electronic PDF format on one (1) CD. Final copies of manuals to be received by Engineer not less than seven (7) days prior to substantial performance.
.2 All maintenance manual data shall be printed on 8 1/2" x 11" heavy bond, indexed, tabbed, punched and bound in the binders. Each manual shall have a title sheet which is labeled "Operation & Maintenance Manual", and lists the Project name, Contractor's and Engineer's names, date submitted, and a Table of Contents for each volume. If a manual exceeds 75 mm in thickness, provide additional manuals as required.

.3 Each section of the manual shall contain the following information:

- Systems Descriptions. A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.
- Descriptive and technical data.
- Maintenance and operating instructions for all electrical equipment and controls. (These operating instructions need not be manufacturer's data but may be typewritten instructions in simple language to guide the WCB in the proper operation and maintenance of his installation.)
- A copy of all wiring diagrams complete with wire coding.
- List of spare parts of all electrical equipment complete with names and addresses of sales, service representatives and suppliers.
- Copy of test data
- Include type and accuracy of instruments used to obtain test data.
- Copy of final inspection certificate.
- Copy of the purchase order, showing equipment make and model numbers issued to the manufacturer complete with all addendums. All cost details may be hidden.
- Copy of all warranty certificates.
- Set of final reviewed Shop Drawings.
- Names, addresses, phone numbers and facsimile numbers of Contractor, Engineers, sub-contractors and suppliers used on the Work together with a specification reference of the portion of the Work they undertook.
- Hard copy of drawings. AutoCad of drawings. These are provided by the Engineer.
- Training Log.
- Commissioning sheets.

1.8 Product Handling

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the WCB and to the approval of the Engineer.

.3 Remove advertising labels from all electrical equipment. Do not remove identification of certification labels.
.4 Remove dirt, rubbish, grease, etc. resulting from this work from all surfaces, including the inside of all cabinets, equipment enclosures, panelboard tubs, walls, ceilings etc.

1.9 Disposal and Waste Management

.1 Contractor to supply appropriate bin and transport for disposal of existing equipment.

1.10 Alternate and Separate Prices

.1 In accordance with the Instructions to Bidders, state on the Tender Form in the space provided, the amount to be added or deleted from the base bid tender amount for the use and installation of equipment as an alternate to those specified.

1.11 Guarantee

.1 Furnish a written guarantee to the WCB prior to final contract payment, which will be in effect for one (1) year from the date of final acceptance (substantial completion) of the complete work. Replace or repair at no cost to the WCB any defective material or workmanship except where, in the opinion of the Engineer, such defects are due to the misuse or neglect by the WCB.

.2 This general guarantee shall not act as a waiver of any specified or special equipment guarantees which cover a greater length of time.

1.12 Progress Claims

.1 Within ten (10) days after award of contract, a breakdown of material and equipment items including labour and expense components shall be compiled in format to Engineer's approval. Subsequent requests for payment shall be documented accordingly.

2.0 PRODUCTS

2.1 Selected Products and Equivalents

.1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The Contractor shall be responsible to remove and replace defective products at their expense, and shall be responsible for any resulting delays and associated expenses which result from defective products being rejected. Related materials shall be of the same manufacturer throughout the project.

.2 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Tender.

.3 The design has been based on the use of the specified product.
2.2 Alternative Products

.1 All product substitutions must be approved by the Engineer/WCB. Failure to obtain approval from the Engineer will result in the alternative product being rejected, in which case the Contractor shall provide an approved product at no additional cost to the WCB.

.2 The Contractor shall assume full responsibility for ensuring that when providing alternative products or materials, all space, weight, connections, power and wiring requirements etc. are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts and plans, etc. that may be necessary will be borne by the Contractor.

.3 Suppliers must submit all requests for alternative product to WCB for approval. Submissions must be received by WCB prior to the “Bid Inquiries” closing date stated in the IFB document.

.1 All submissions which are approved by WCB/Engineer shall be identified as ”Approved Alternatives” in an Addendum. Alternative products not listed in the Addendum will be rejected.

.4 Approval of an alternate is not intended to change the original specifications unless specifically stated in the addenda. The submittor is responsible for all costs incurred by other trades as well as his own, to install the product/system in accordance with the contract documents.

.5 All submissions to be provided with technical data and whatever pertinent information that may be required by WCB and the Engineer to evaluate equivalency to the specified product. The responsibility to provide sufficient technical data with respect to submissions will remain solely with those making the submission.

2.3 Quality of Products

.1 All products provided shall be CSA approved, Canadian Underwriters’ Laboratory approved where applicable, and new, unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval from the local regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Engineer.

2.4 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.
2.5 Product Finishes

.1 Finish all cabinets, panelboards, switchboards, equipment cabinets, cable trays, etc. in ANSI 61 grey enamel unless otherwise specified.

.2 Apply primer on all items which are to be finished on the job.

.3 Touch up all damaged painted finishes with matching lacquer, or, if required by the Engineer, completely repaint damaged surface.

2.6 Use of Products During Construction

.1 Any equipment used for temporary or construction purposes shall be approved by WCB and in accordance with the General Conditions, "Use of Premises". Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

.2 The warranty period shall not begin until the date of substantial performance of the work.

3.0 EXECUTION

3.1 Site Examination

.1 Examine the site of work and become familiar with all features and characteristics affecting this work during mandatory pre-bid meeting.

.2 No additional compensation will be given for extra work due to existing conditions which such examination should have disclosed.

.3 Report to the Engineer any unsatisfactory conditions which may adversely affect the proper completion of this work.

3.2 Coordination with Other Divisions

.1 Examine the drawings and specifications of all divisions and become fully familiar with their work. Before commencing work, obtain a ruling from the Engineer if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.

.2 Lay out the work and equipment with due regard to architectural, structural and mechanical features.

.3 Do not cut structural assemblies without approval of the Engineer/WCB.

.4 Coordinate with all Division installing equipment and services, and ensure that there are no conflicts.

.5 Examine previously constructed work and notify the WCB/Engineer of any conditions which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.
3.3 Separation of Services

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

.3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Engineer and the ceiling installer, and approved clips or hangers are used.

3.4 Equipment Identification

.1 3 mm thick plastic laminoid name plates, black face, white core, mechanically attached with self-tapping screws, 6 mm high lettering, to be attached to the front face of the all electrical equipment such as panelboards.

.2 Colour code all new exposed conduits and BX cable (including conduits above T-bar ceilings), junction and pull boxes, and metallic sheathed cables with paint or plastic tape (25 mm wide band) at 3 metre intervals. Colour coding to be as follows or match existing:

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>MAJOR BAND</th>
<th>MINOR BAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>347/600V Normal</td>
<td>Sand</td>
<td></td>
</tr>
<tr>
<td>347/600V Emerg.</td>
<td>Sand</td>
<td>Red</td>
</tr>
<tr>
<td>120/208V Normal</td>
<td>Grey</td>
<td></td>
</tr>
<tr>
<td>120/208V Emerg.</td>
<td>Grey</td>
<td>Red</td>
</tr>
<tr>
<td>208V UPS System</td>
<td>Grey</td>
<td>Orange</td>
</tr>
<tr>
<td>600V UPS System</td>
<td>Sand</td>
<td>Orange</td>
</tr>
<tr>
<td>Fire Alarm System</td>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>BMS (AC controls)</td>
<td>Pink</td>
<td></td>
</tr>
<tr>
<td>Sensors(temp/leak)</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Low voltage switching</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Low Level Paging (Ceiling Speakers)</td>
<td>Dk. Green</td>
<td></td>
</tr>
<tr>
<td>EPO</td>
<td>Pink</td>
<td>(&quot;EPO&quot; label)</td>
</tr>
<tr>
<td>ADT alarm monitoring</td>
<td>Purple</td>
<td></td>
</tr>
<tr>
<td>Commercial Television</td>
<td>Dk. Brown</td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>Yellow</td>
<td></td>
</tr>
</tbody>
</table>
.3 All conductors shall be identifiable by coloured insulation and permanent markers at every terminal and accessible points throughout its entire run.

Conductors:
Equipment Grounding - Green
Neutral Conductor - White

<table>
<thead>
<tr>
<th>347/600 Volt System</th>
<th>120/208 Volt System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A - Orange</td>
<td>Phase A - Red</td>
</tr>
<tr>
<td>Phase B - Brown</td>
<td>Phase B - Black</td>
</tr>
<tr>
<td>Phase C - Yellow</td>
<td>Phase C - Blue</td>
</tr>
</tbody>
</table>

3.5 Instructions to WCB’s Personnel (Training)

.1 Refer to Section 26 05 07 - Electrical Equipment and Systems Demonstration and Instruction.

.2 Coordinate training seminar with WCB.

3.6 Sealing of Wall and Floor Openings

.1 All conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries shown on the drawings have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect conduits, cable wiring jacket or insulating material. Utilize Hilti, 3M or approved equal caulking or fire bricks.

3.7 Insulation Resistance Testing

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of Engineer.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Submit test results for Engineer’s review.
3.8 Construction Sequence

.1 Refer to IFB Section 12.4 for the construction hours of work.

END OF SECTION
1.0 GENERAL

1.1 Documents

.1 This section of the specification forms a part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Existing Conditions

.1 Examine site during mandatory pre-bid meeting and be responsible for ascertaining all conditions which will affect this trade whether shown on the drawings or not and to take all the necessary measurements.

.2 Investigate and confirm the locations, the method of connections and routes of existing and new electrical facilities. Report at once any discrepancy between drawings, specifications and existing conditions.

.3 Absorb any costs incurred by failure to carry out this investigation and examination.

1.3 General Requirements

.1 Provide and be responsible for the removal, relocation, reconnection, etc., of electrical devices, equipment, material, etc., as indicated on the drawings and/or as required by renovations to existing building.

.2 All electrical devices and equipment which are disconnected, removed from service, etc., and which are not reused on the job and not required are to be offered to the Owner. If refused, remove from site and recycle at the Contractors expense. Remove and recycle of all components properly and provide a proof of recycling.

.3 Continuity of power, fire alarm and communication shall be maintained or restored promptly where services to other portions of a site are affected by the renovation.

1.4 Mop Planning/Shutdowns

.1 Method of Procedure (MOP) plan to be provided by the contractor to the Owner and Consultant team for review and approval during an Electrical Power Pre-Change Over meeting. Meeting to be attended by the Electrical Foreman, User group, WCB, Electrical Consultant, and other required personnel. The general outline of the plan to be submitted as follows:

.1 List all loads to be shut down.

.1 Distribution.
.2 Sub-distribution.
.3 Panels.
.4 Circuits.
.5 Generators.
2.0 PRODUCTS

.1 Manufacturers of existing devices and equipment where known are indicated on the drawings or in the specifications.

.2 Material and equipment added shall match existing wherever possible unless otherwise noted.

3.0 EXECUTION

3.1 General

.1 Provide all labour and materials required to revise existing electrical facilities as indicated on the drawings and/or as required by building renovations and for installation of new electrical systems.

.2 Existing facilities shall remain operational during construction period. When renovations are complete, all facilities shall be checked and tested and shall be left in a proper working order and to the satisfaction of Engineer and Owner.

3.2 Existing Systems and Shutdowns

.1 Where the work of the Contract requires a shutdown or will otherwise affect an existing electrical system, Contractor is to obtain written permission/confirmation of coordination with WCB seven (7) days in advance. I.e. Installation of breakers in panelboards.

.2 All costs related to non-coordinated nuisance alarms or the fire alarm system caused by this Contractor will be borne by this contractor (i.e. false charges by Fire Department). Contractor will pay costs associated with clearing the building (salaries and lost time for all employees).
Sample Method of Procedure for Load Transfer, Bus Shutdowns, and other Disturbances on the Electrical System.

Sequence of Load Transfer

<table>
<thead>
<tr>
<th>Day #</th>
<th>Item</th>
<th>Day</th>
<th>Date</th>
<th>Start Time</th>
<th>End Time</th>
<th>Description of Task</th>
<th>Done</th>
<th>Effect</th>
<th>Task Performed By</th>
<th>Team #</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DESCRIPTION OF TASK TO BE COMPLETED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### EXAMPLE:

<table>
<thead>
<tr>
<th>Day #</th>
<th>Item</th>
<th>Day</th>
<th>Date</th>
<th>Start Time</th>
<th>End Time</th>
<th>Description of Task</th>
<th>Done</th>
<th>Effect</th>
<th>Team Performed By</th>
<th>Team #</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>08:00</td>
<td>08:30</td>
<td>Open and lock breaker 20-6 in penthouse CDP feeding CDP 3DE1. Open and lock gen#1 breaker feeding CDP 3DE1.</td>
<td></td>
<td>All emergency loads are offline (All elevators, MCC E1, emergency lighting, plugs to data closets, fire pump, A/C units, UPS units are all offline).</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test data centre pre-action system.</td>
<td></td>
<td>FOR INFO ONLY. NOT PART OF THIS PROJECT.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.2a</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>08:30</td>
<td>10:00</td>
<td>Terminate transformer T-10Z to panel 10Z in penthouse level.</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.2b</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>08:30</td>
<td>13:00</td>
<td>Install key interlocks on two existing breakers in CDP 6DEB. Replace existing switchgear lights with LED type.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.2c</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>08:30</td>
<td>10:00</td>
<td>Install new 450A main breaker c/w key interlock in CDP 3DE1. GENIVAR to provide coordination study for Schneider to set and commission.</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Replace three (3) EPO relays in data centre.</td>
<td></td>
<td>FOR INFO ONLY. NOT PART OF THIS PROJECT.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>10:00</td>
<td>11:30</td>
<td>Terminate transformer T-1Z to panel 1Z in parkade level.</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.4</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>11:30</td>
<td>13:00</td>
<td>Disconnect neutral conductors.</td>
<td></td>
<td></td>
<td>1,2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.5</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>13:00</td>
<td>13:30</td>
<td>Test key interlocks to ensure they function. Main breaker in 3DE1 shall be closed, tie in 6DEB open, main breaker in CDP 6DEB closed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.6</td>
<td>Sunday</td>
<td>Apr 25/10</td>
<td>13:30</td>
<td>14:00</td>
<td>Close gen#1 breaker, close 20-6 breaker.</td>
<td></td>
<td>Energize CDP 3DE1 and all emergency loads.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
1.0 GENERAL

1.1 Intent

.1 Except where otherwise specified, arrange and pay for testing, adjusting, balancing and related requirements specified herein.

.2 If test results do not conform with applicable requirements, repair, replace, adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.3 Provide all labour, materials, instruments and equipment necessary to perform the tests specified.

.4 All tests shall be witnessed by persons designated by the WCB/Engineer, who shall also sign the test documentation.

.5 Submit procedures proposed in writing for approval one (1) weeks prior to test. (MOP - refer to section 26 05 01).

1.2 Related Work

.1 Electrical General Requirements

1.3 Manufacturer's Production Test Records

.1 If requested, submit copies of production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment.

1.4 Site Testing Reports

.1 Log and tabulate test results on appropriate test report forms.

.2 Submit forms to Engineer for approval prior to use.

.3 Submit completed test report forms as specified, immediately after tests are performed.

1.5 Reference Documents

.1 Perform tests in accordance with:

.1 The Contract Documents

.2 Requirements of authorities having jurisdiction

.3 Manufacturer's published instructions

.4 Applicable CSA, IEEE, IPCEA, EEMAC and ASTM standards

.2 If requirements of any of the foregoing conflict, notify Engineer before proceeding with test and obtain clarification.
1.6 Sequencing and Scheduling
   .1 Except where otherwise specified, perform all testing, adjusting, balancing and related requirements specified herein prior to Interim Acceptance of the Work.

2.0 PRODUCTS
2.1 Test Equipment
   .1 Provide all equipment and tools necessary to perform testing, adjusting and balancing specified herein and as otherwise required.

3.0 EXECUTION
3.1 Testing of Wiring and Wiring Devices
   .1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by cable manufacturer. Test results shall be properly tabulated, signed, dated and submitted with maintenance manuals.
   .2 Test service grounding conductors for ground resistance.
   .3 Test all wiring devices for correct operation.
   .4 Test all receptacles for proper polarity and circuitry.

3.2 Testing of Luminaires and Lighting Controls
   .1 Test that luminaires function. Ensure lighting controls function and are set properly.
   .2 Manufacturer’s representative shall test, program and commission all lighting controls.

END OF SECTION
1.0 GENERAL

1.1 Intent

.1 Provide demonstration and instruction sessions to familiarize Owner's operation and maintenance personnel with electrical systems and their operation and maintenance.

.2 Submit system sign off sheets for each system listed prior to substantial completion.

.3 All sign off and survey sheets shall be typewritten.

1.2 Contractor/Owner Coordination

.1 Contractor will chair demonstration and instruction sessions.

.2 Establish agendas for demonstration and instruction sessions in conjunction with Owner. Coordinate scheduling of sessions with WCB.

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION

3.1 Systems Demonstration

.1 Demonstrate operation of following systems:

.1 Lighting and lighting controls.

END OF SECTION
1.0 GENERAL

1.1 Description

.1 Securely and adequately ground all components of the electrical system in accordance with the requirements of all related sections in the latest Canadian Electrical Code, Alberta Building Code and the local Electrical Inspection Authority.

.2 The system is to consist of cables all necessary materials and inter-connections to provide a complete system.

.3 All ground conductors shall be run in conduit.

1.2 References

.1 CEC code.

2.0 PRODUCTS

2.1 Equipment

.1 All ground wires to be stranded copper TWH complete with a green jacket unless otherwise shown.

.2 Cable to pipe connectors to be made with Burndy GAR connectors.

.3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

  .1 Grounding and bonding bushings.
  .2 Protective type clamps.
  .3 Bolted type conductor connectors.
  .4 Bonding jumpers, straps.
  .5 Pressure wire connectors.

3.0 EXECUTION

3.1 General

.1 Install complete permanent, continuous grounding system including: conductors, accessories. Where EMT is used, run ground wire in conduit. All connectors shall be installed in accordance with manufacturer’s requirements. All frames and metallic enclosures of all electrical equipment and electrically operated equipment shall be grounded via a ground wire.

.2 Expansion joints and telescoping sections of raceways shall be bonded using jumper cables as per Canadian Electrical Code.

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Supply and install all hangers, supports and inserts for the installation shown on the drawings and specified herein, as necessary to fasten electrical equipment securely to the building structure.

1.2 Related Work

.1 Conduit, Conduit Fastening and Conduit Fittings. Section 26 05 34

.2 Outlet Boxes, Conduit Boxes and Fittings Section 26 05 32

2.0 PRODUCT

2.1 Framing and Support System

.1 Materials:

.1 Intermediate duty supporting structures shall employ P1000 Unistrut or equal together with the manufacturers connecting components and fasteners for a complete system.

.2 Heavy duty supporting structures to be fabricated and welded from steel structural members and prime painted before installation.

.2 Finishes:

.1 Outdoors, wet locations: Hot dipped galvanized.

.2 Indoors, dry locations: Galvanized when available, prime painted if not available.

.3 Nuts, bolts, machine screws: Cadmium plated.

.3 Unistrut:

.1 Section P1000, P3300 or as required for load and span, with mounting screws, or approved. P1000 or equal is a minimum standard for supporting conduits 50 mm and larger.

2.2 Concrete and Masonry Anchors

.1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. All anchor bolts must be galvanized.

.2 Components: Non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal.
2.3 Non-Metallic Anchors

.1 Material: Plastic anchors for sheet metal screws.

.2 Manufacturer: Fischer.

2.4 Conduit Supports

.1 Unistrut support racks: Unistrut conduit clamps.

2.5 Cable Supports and Clamps

.1 General: As per conduit supports, except that for single conductor cables, suitable non-ferrous, or approved stainless steel or aluminum clamps shall be used.

3.0 EXECUTION

3.1 General

.1 Do not cut or drill beams, joists or structural steel unless written permission of the Engineer is obtained.

.2 Distance between conduit or cable supports not to exceed code requirements.

.3 Supports to be suitable for the real loads imposed by equipment.

.4 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over a 1 meter span and 8 mm over a 2 meter span.

.5 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.6 Provide conduit rack with 25% spare capacity for multiple runs.

.7 Provide channel support with fittings for vertical runs of conduit and cables.

3.2 Installation

.1 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.

.2 Support two (2) or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.
.2 Use plastic anchors for light loads only. Use metal anchors for all other loads.

.3 Shot driven pins may only be used with written approval of the structural engineer.

.4 Use round or pan head screws for fastening straps, boxes, etc.

.5 Do not support heavy loads from the bottom chord of open web steel joists.

.6 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with a minimum of four 6 mm fasteners.

.7 For surface mounting of two (2) or more conduits use channels at 1.5 m oc spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Consultant.

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Provide a complete system of splitters boxes and cabinets for the installation of wiring and equipment.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00 – Electrical General Requirements.

2.0 PRODUCTS

2.1 Junction Boxes and Pull Boxes

.1 Materials:

.1 Code gauge sheet steel, welded construction, phosphatized and factory paint finish.

.2 Lockable, weatherproof and corrosion resistant when installed outdoors.

.2 Components:

.1 Boxes 200 mm x 200 mm and larger are to be complete with hinged covers. Hinged covers are to be constructed using pin style or piano hinges. Formed steel hinge assemblies are not acceptable.

.2 For flush mounting, covers to overlap box by 25 mm minimum all around with quarter turn latch.

.3 Use rolled edges for surface boxes.

.3 Junction boxes mounted in exterior walls shall be complete with box vapour barriers.

2.2 Cabinets

.1 Materials:

.1 Cabinets: Code gauge sheet steel, welded construction, phosphatized and factory paint finish, suitable for field painting.

.2 Locks: to match panelboards.

.3 Backboards: 19 mm GIS fir plywood, one piece per cabinet, covering entire cabinet interior.
.2 Components:

.1 With hinged door and return flange overlapping sides, with handle, lock and catch for surface mounting, size as indicated or to suit.

.2 Surface or flush with trim and hinged door, latch and lock and two (2) keys, size as indicated or to suit. Keyed to match panelboard keys 19 mm GIS Plywood backboard.

3.0 EXECUTION

3.1 Installation

.1 Junction Boxes and Pull Boxes:

.1 Supply all pull boxes and junction boxes shown on the drawings or required for the installation.

.2 Boxes installed in walls to be offset by a minimum of one stud space.

.3 Install in inconspicuous but accessible locations, above removable ceilings or in electrical rooms, utility rooms or storage areas.

.4 Identify with system name and circuit designation as applicable.

.5 Size in accordance with the Canadian Electrical Code, as a minimum.

.2 Cabinets:

.1 Mount cabinets with top not greater than 1980 mm above finished floor, coordinated with masonry, panelboards, fire hose cabinets and similar items. Securely fasten backboards to cabinet interiors.

.2 Install terminal blocks where indicated.

.3 Identification

.1 Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Provide a complete system of boxes for the installation of wiring and equipment.

1.2 Related Sections

.1 Electrical General Requirements Section 26 05 00

1.3 References

.1 CSA C22.1-Canadian Electrical Codes, Part 1.

2.0 PRODUCTS

2.1 Material

.1 Interior Boxes: Provide galvanized sheet steel boxes, blanked for conduit, attached lugs for locating.

.2 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Components

.1 Ceiling outlets, surface mounting, concealed:

.1 101 mm square, depth 54 mm, Iberville 52171 series.
.2 119 mm square, depth 54 mm, Iberville 72171 series.

.2 Ceiling outlets, concealed mounting in concrete:

.1 101 mm octagonal concrete rings, depth from 38 mm to 152 mm Iberville 54521 series.
.2 Extension ring to change from recessed conduit to exposed conduit, 101 mm octagonal, 38 mm deep square Iberville 53151-1/2 or 38 mm deep octagonal Iberville 51151C or 54 mm deep, Iberville 55171C.

.3 Wall outlets, concealed non-masonry construction, with plaster finish: for one (1) or two (2) gangs used with switches, receptacles, etc., use 54 mm deep Iberville 52171 series, with matching plaster covers, depth to suit. Alternately, use 119 mm square boxes, Iberville 72171 series and covers as required. (For more than two (2) gangs use solid boxes Iberville GSB series with GBC series cover, or special boxes as required.)

.4 Wall outlets, surface, exposed mounting or used for outdoor outlets: one or more gang, Crouse-Hinds FS series or FD series, condulet.

.5 Covers: Unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.
3.0 EXECUTION

3.1 Installation

.1 All outlet boxes to be flush mounted in all areas except mechanical rooms, electrical rooms, above removable ceiling and crawl spaces.

.2 Support boxes independently of connecting conduits.

.3 No sectional, gangable or handy boxes are to be used.

.4 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.6 Provide correct size of openings in boxes for conduit or cable connections. Reducing washers are not allowed.

.7 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.8 Use plaster rings to correct depth. Use 30 mm on concrete block.

.9 Provide boxes sized as required by the Canadian Electrical Code. All boxes are to be the deep type as a minimum.

.10 Install vapour barrier material to surround and seal all outlet boxes located on all walls of the bio-hazardous room. Maintain wall insulation where applicable.

.11 Outlets installed in party walls to be offset by a minimum of one stud space.

.12 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.

.13 For outlets mounted above counters or in millwork coordinate location and mounting heights prior to installation.

.14 Outlets flush mounted in T-bar ceilings shall be supported with "Caddy" type supports spanning to T-bar grid.

.15 Outlet boxes in metal stud walls are to be solidly anchored on two sides of the box to the wall system to ensure box will not move within the wall.

END OF SECTION
1.0 GENERAL

1.1 Description

.1 Supply and install a raceway under the raised floor for power and data.

.2 The raceway shall be provided with a barrier, where required, to separate compartments for normal and emergency power circuits and/or communication cables where indicated on the drawings.

.3 The system shall be suitable for 208V distribution.

1.2 Related Work

.1 Wire and Cables, 0 – 1000V

2.0 PRODUCTS

2.1 Manufacturer

.1 The system shall be as manufactured by Wiremold Canada Inc. or equal

.2 Provide basket tray 6" wide and 4" deep basket tray for data and 6" wide and 4" deep ladder cable tray for power.

.3 Where not indicated, select proper types and sizes to fulfill wiring requirements and comply with Canadian Electrical Code (CEC).

2.2 Metallic Raceway System

.1 Finish: white enamel for data and ANSI Grey for power.

.2 Fittings to include internal and external elbows, couplings, wire clips, blank end fittings, device mounting brackets and plates.

3.0 EXECUTION

3.1 Installation

.1 Install raceways in a neat and orderly manner before installation of wiring.

.2 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.

.3 Install complete cable tray system.

.4 Support cable tray on both sides at 900 mm, on center spacing.

.5 Use wiring with mechanical protection in channel raceways.
.6 Install barriers in raceways where different voltage systems and/or communication cables are indicated.

.7 Use continuous lengths for runs less than 3 m. For shorter lengths, field cut to suit. Carefully cut all barriers bases. Make cuts at right angles. Cut edges to be free from burrs, sharp edges, bends and other distortions. Use a floor mounted power hacksaw or similar device for cuts.

.8 In-feeds are to be conduit run concealed in walls and ceiling space. Subfeed to wall or bench mounted receptacles shall be conduit installed concealed in finished areas or in service columns provided.

.9 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 Grounding

.1 Provide #6 AWG bonding conductor within all cable trays. Bond at 5M intervals by cable tray ground clamp.

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Provide a complete system of conduit and fittings for installation of wiring.

1.2 Related Work

.1 General Electrical Requirements  Section 26 05 00

2.0 PRODUCTS

2.1 Rigid Steel Conduit

.1 Galvanized with threaded joints and connections.

.2 Connections in dry locations: steel or malleable iron locknuts inside and outside enclosures. Insulated bushings Thomas & Betts Series 222 or approved alternate.

.3 Connectors subjected to moisture interior and exterior: liquid and dust tight with insulated throat, Thomas & Betts "Bullet Hub" 370 Series or approved alternate.

.4 Fittings: cast metal "Condulet" as manufactured by Crouse-Hinds Canada Ltd. including gasketted covers in damp locations.

.5 Expansion joints: cast metal Crouse-Hinds Type XJ or approved alternate.

2.2 E.M.T. Conduit

.1 Fittings in dry locations: Zinc set screw connectors (or Steel with insulated throat). Zinc set screw (or Steel) couplings.

.2 Fittings in wet locations: Steel rain tite connectors with insulated throat. Steel rain tite couplings.

2.3 Rigid P.V.C. Conduit

.1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured by IPEX, "Sceptre" Schedule 40.

.2 Accessories: Bell ends, couplings, adapters, bends and other fittings of same material as duct. Use solvent recommended by manufacturer.

2.4 Flexible Conduit

.1 Connectors: slip-proof, insulated throat or non-metallic bushings, steel, Thomas & Betts Ltd. "Tite-Bite", Series 300.
2.5 Liquid-Tight Flexible Conduit

.1 Conduit: flexible metal conduit with liquid-tight PVC jacket. Industrial Wire & Cable "Liquiseal".

.2 Connectors: captive sealing jacket and ground cone insulated throat, steel (Thomas & Betts Ltd. "Super-Tight", Series 6000).

2.6 Zinc Fittings

.1 Connectors and couplings to be manufactured of No. 3A alloy conforming to ASTM designation B.240.

3.0 EXECUTION

3.1 Rigid Steel Conduit

.1 Use as raceways for following applications:

- Expose conduit stub ups from concrete slabs.
- In all areas exposed to weather.
- Locations where mechanical damage may occur and in mechanical rooms to a height of 1 metre.
- Through grade beams or where "shear" conditions are present.

3.2 E.M.T. Conduit

.1 Use as raceways for following applications: 21 mm (3/4" minimum size):

- In surface and concealed areas or in poured concrete above ground level.
  Do not use in "slab on grade" concrete pours.

.2 It may not be used in damp locations, corrosive atmosphere, underground, outdoors, nor in areas exposed to mechanical damage.

3.3 Rigid P.V.C. Conduit

.1 Use as raceways for following applications:

- In poured concrete floors and walls and on underground runs exterior to the buildings unless otherwise noted.
- Wiring installed in areas subject to intermittent or continuous moisture but not surface mounted.
- Rigid PVC conduit shall not be surface mounted.
.2 Use strictly in accordance with the Canadian Electrical Code. Do not use in return air plenums and for exit and fire escape lights.

.3 Provide insulated ground wire in all rigid PVC conduits in accordance with the Canadian Electrical Code.

.4 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions.

.5 Bend rigid conduit in strict accordance with manufacturer's directions. Distorted bends will not be accepted.

3.4 Flexible Conduit

.1 Use as raceways for following applications:
  - Flexible connections to luminaires.

.2 Provide a separate insulated ground wire in all flexible conduits.

3.5 Installation

.1 Install all conduit and wiring concealed, unless otherwise shown on the drawings. Do not recess conduit in columns, except as noted, without permission.

.2 Where conduit is run exposed, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on Unistrut racks.

.3 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

.4 Where steel conduit is required to be bent, do not heat, and do not bend conduit in such a way as to reduce pipe cross section area at any point. Radii of bends shall be as per Canadian Electrical Code.

.5 For all runs of conduits, do not include more than equivalent of 4 - quarter bends. Provide conduit fittings, pullboxes and junction boxes where necessary. Pulling elbows shall not be used except by special permission.

.6 Where possible, install conduits so that they are not trapped, cap turned up conduits to prevent the entrance of dirt of moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

.7 Take extreme care in reaming ends of all conduit to ensure a smooth interior finish that will not damage the insulation of the wires.
.8 Use insulated non-metallic bushings on all conduit terminations 27 mm (1") and larger.

.9 Ensure electrical continuity in all conduit systems.

.10 All conduits shown exposed in finished areas is to be free of unnecessary labels and trademarks.

.11 Install a 90 lb. test line in all conduits left empty by this contractor including those which others will pull cables, wires, etc. Identify on record drawings.

.12 Conduits and ducts crossing building expansion joints shall have conduit expansion fittings to suit the type of conduit used, and shall be Crouse-Hinds, Appleton or approved fitting.

.13 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with 1hr fire rated 3M sealant, Hilti sealant or approved equal.

.14 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on the drawings are installed, wall openings shall be closed with material compatible with the wall construction. Review size and quantity of conduit sleeves with the Engineer.

.15 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.

.16 Where conduit finish is damaged, repair or replace.

.17 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of boxes where support is not provided.

.18 All branch circuit wiring, home-runs, communication and data to be minimum 21 mm diameter unless otherwise stated.

.19 Where panelboard branch circuit conduits are amalgamated, size shall not exceed 27 mm diameter.

END OF SECTION
1.0 General

1.1 RELATED DOCUMENTS – NOT APPLICABLE

1.2 SUMMARY

.1 Modify existing 'nLight' lighting control system to accommodate the manual lighting and sensors in all rooms as per Building Systems.

1.3 DEFINITIONS – NOT APPLICABLE

1.4 SUBMITTALS

.1 Product Datasheets (general device descriptions, dimensions, wiring details, nomenclature).

.2 Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices).

.3 Other Diagrams – as needed for special operation or interaction with other system(s).

.4 Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up.

.5 Hardware and Software Operation Manuals.

.6 Other operational descriptions as needed.

1.5 QUALITY ASSURANCE

.1 All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.

.2 All components and the manufacturing facility where product was manufactured must be ROHS compliant.

.3 In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

.4 All applicable products must be UL / CUL Listed or other acceptable national testing organization.
1.6 COORDINATION

.1 Coordinate lighting control components to form an integrated interconnection of compatible components.

.2 The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

.3 All areas of the building shall have functional manual/auto lighting control as shown on drawings.

1.7 WARRANTY

.1 All devices in lighting control system shall have a five (5) year warranty.

2.0 Products

2.1 MANUFACTURERS

.1 The drawing and this specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).

2.2 INDIVIDUAL DEVICE SPECIFICATIONS

.1 Control Module (Gateway)

.1 Module shall be a wall mounted user accessible device that is capable of communicating and controlling downstream system control devices and linking into an Ethernet.

.2 Devices shall be powered by low voltage, fit within a two gang switch box (or mounting ring), and have a backlit LCD panel.

.3 User control shall be made available via finger-touch buttons with no moving parts. Buttons shall be capable of being locked for security.

.4 Device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to a lighting control zones devices.

.5 Device shall automatically detect all devices downstream of it.

.6 Device shall have a standard and astronomical internal time clock.

.7 Device shall have one RJ-45 10/100 BaseT Ethernet connection.

.8 Each control gateway device shall be capable of linking 400 devices to the management software.

.9 Device shall be capable of using a dedicated or DHCP assigned IP address.
.2 Networked System Occupancy Sensors

.1 Occupancy sensors system shall sense the presence of human activity within the desired space and automatically control the on/off function of the lights. Occupancy sensors shall be c/w manual bypass switch as well.

.2 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

.3 For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.

.4 Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

.5 All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

.6 Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 347 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.

.7 Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.

.8 Sensors shall be available in multiple lens options which are customized for specific applications.

.9 Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5E low voltage cabling with RJ-45 connectors.

.10 All sensors shall have two RJ-45 ports.

.11 All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5E connections) and blink its LED in a pattern to visually indicate of a potential wiring issue.
.12 Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.

.13 Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5E cabling.

.14 Sensors shall be equipped with an automatic override for one hundred (100) hour burn-in of lamps. This feature must be available at any time for lamp replacements.

.15 Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

.16 Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.

.17 Provide white coloured switches.

.18 Network system shall also have ceiling, fixture, recessed, and corner mounted sensors available.

.19 Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.

.20 Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).

.3 Networked System Power (Relay) Packs

.1 Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2<sup>nd</sup> relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.

.2 Power Packs shall accept 120 or 347 VAC, be plenum rated, and provide Class 2 power to the system.

.3 All devices shall have two RJ-45 ports.

.4 Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
.5 Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

.6 When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

.7 Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all load types, and be rated for 400,000 cycles.

.8 Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts.

.9 Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/347 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).

.10 Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.

.4 Communication Bridges

.1 Device shall surface mount to a standard 4" x 4" square junction box.

.2 Device shall have 8 RJ-45 ports.

.3 Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.

.4 Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5E cabled connection.

.5 Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
2.3 LIGHTING CONTROL PROFILES

.1 Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.

.2 Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.

.3 All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.

.4 Every device parameter (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.

.5 All lighting control profiles shall be stored on the network control gateway device and on the software's host server.

.6 Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/− timed offsets.

.7 Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

.8 Daylight savings time adjustments shall be capable of being performed automatically, if desired.

.9 Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.

.10 Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.4 START-UP & SUPPORT FEATURES

.1 To facilitate start-up, all devices daisy-chained together (using CAT-5E) shall automatically be grouped together into a functional lighting control zone.

.2 All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

.3 Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

.4 All system devices shall be capable of being given user defined names.

.5 All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

.6 All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
2.5 COMMISSIONING, TESTING AND PROGRAMMING

.1 Licensed network lighting controls representative shall coordinate with Contractor to aid in the installation, program all devices, set-up time schedules to suit WCB’s operations. Coordinate with WCB/Engineer for the pre-set time delays for the occupancy sensors and scheduling.

.2 Lighting controls representative/Contractor shall test all devices to ensure functionality. Tabulate that all switches, occupancy sensors function as intended and record in O&M Manuals. Ensure all fixtures sweep off and have a flick warning. Ensure all fixtures can be bypassed on after it is turned off and that it will be turned off after a pre-set time period.

.3 Contractor to arrange and pay for testing, adjusting, balancing and related requirements. If test results do not conform with requirements, replace, repair, adjust equipment and repeat testing as necessary until acceptable results are achieved. Provide all labour necessary to perform tests.

END OF SECTION
1.0 WORK INCLUDED

.1 Provide a complete system of wiring, making all connections necessary for the installation shown on drawings.

1.1 References, Codes and Standards

.1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.


.3 Install and rate power cables in accordance with the Canadian Electrical Code requirements or in accordance with ICEA requirements where permissible.

1.2 Related Sections

.1 General Electrical Requirements Section 26 05 00

.2 Testing, Adjusting and Balancing of Electrical Systems Section 26 05 07

1.3 Product Data

.1 Submit product data in accordance with Section 26 05 00 – Electrical General Requirements.

2.0 PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 14 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: Size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

2.2 Teck Cable

.1 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.2 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking galvanized aluminum.
2.3 Armoured Cables (BX)

.1 Conductor: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Type: flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

3.0 EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

3.2 Installation of Teck Cable 0 – 1000 V

.1 Install cables.

.2 Group cables wherever possible on channels.

.3 Install cable in conduit in accordance with Section 26 05 34.

3.3 Installation of Armoured Cables (BX)

.1 Group cables wherever possible.

.2 For final luminaire connections (max 10’) only or inside existing walls.

3.4 Workmanship

.1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

.2 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.

.3 Do not install any conductor smaller than #12 AWG, except where specifically indicated otherwise, i.e. for fire alarm system station circuits, P.A. wiring, etc.
.4 Provide sizes of conductors as shown on drawings. Voltage drop from lighting panels to farthest outlet must not exceed 2% at full load in any case. Advise Consultant if problem is foreseen.

.5 Exercise care in stripping insulation from wire. Do not nick conductors.

3.5 Identification, Coding and Balancing

.1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 26 05 00 – Electrical General Requirements.

.2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.

.3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two (2) wraps of 3M #471 plastic film tape 48 mm wide.

.4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

.5 For direct current wiring use red for positive and black for negative.

3.6 Testing

.1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by the cable manufacturer.

.2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Consultant.
1.0   GENERAL

1.1   Related Work

   .1   Mechanical Division 20

1.2   Requirements

   .1   Provide a complete system of wiring to motors and controls as specified herein and as shown on the drawings.

   .2   Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under all contracts related to this project. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied under other contracts.

   .3   All control wiring diagrams shown on the drawings illustrate typical control circuits applicable to the equipment. Control circuits may vary with different manufacturers of equipment. Verify all control circuits with the suppliers of the equipment and make any corrections that may be required.

   .4   Unless specifically noted otherwise, supply all pushbuttons, relays, starters, etc., necessary for the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors.

   .5   Do not operate motors and controls until approval is obtained from the trade providing equipment.

   .6   Examine drawings and shop drawings of other Divisions to obtain exact location of motors and equipment shown on drawings. Where necessary, obtain conduit locations from other trades’ drawings and shop drawings.

   .7   Assist in placing in operation all mechanical equipment having electrical connections.

   .8   Provide three phase starters with fused 120 volt control transformers and overload relays.

   .9   Provide all power wiring for all motors and control wiring as indicated on the drawings.

   .10  Refer to Motor Control Equipment Schedule.
2.0 PRODUCTS

2.1 3 Phase Motor Disconnect Switches

.1 Industrial Type "A", having quick make, quick break visible blade mechanism, cover interlocks and padlocking switch in the closed or open position. Use EEMAC 4 enclosures outdoors, and EEMAC 1 indoors switches to be H.P. rated, Westinghouse heavy duty type.

2.2 120 Volt, 1 Phase Disconnect Switches

.1 Manual starter without overload relay.

2.3 208 Volt, 1 Phase Motor Disconnect Switches

.1 Manual starter without overload relay.

3.0 EXECUTION

3.1 Installation

.1 Provide disconnect switches adjacent to all motors.

.2 Install control wiring as indicated on the drawings and the motor control schedules.

END OF SECTION
1.0 GENERAL

1.1 Description

.1 Supply and install contactors as indicated on drawings and specified herein to ensure a complete operational system.

.2 This specification covers contactors for voltages up to 600 V. Refer to drawings for voltage, amperage, number of poles, and auxiliary contacts.

1.2 Product Data

.1 Submit product data in accordance with Section 26 05 00 – Electrical General Requirements.

2.0 PRODUCTS

2.1 Contactors

.1 Contactors: to EEMAC No.1CS.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. This rating shall be on the basis of incandescent or non-inductive loading for continuous operation. All contactors shall have 120V operating coils.

.3 Mount in CSA Enclosure 1 unless otherwise indicated.

.4 Include the following options in cover:

.1 Red indicating lamp.
.2 Hand-Off-Auto selector switch.

.5 Control transformer: sized as required plus 10% in contactor enclosure.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 00 – Electrical General Requirements.

.2 Provide a size 4 nameplate indicating name of load controlled.

3.0 EXECUTION

3.1 Installation

.1 Install contactors and connect auxiliary control devices where indicated on drawings and specified herein.

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Supply and install lighting fixtures complete with lamps, ballasts and all necessary fittings.

1.2 Code Requirements

.1 Installation of lighting equipment to conform to Section 30, Canadian Electric Code, Part 1, and as amended or supplemented by provincial, municipal or other regulatory agencies having jurisdiction.

1.3 Shop Drawings

.1 Submit a complete list of the types of lighting fixtures, lamps, ballasts and accessories with catalogue illustrations, data sheets, etc. for review. Copies of reviewed shop drawings are to be available at the job site at all times.

.2 Submit complete photometric data, based on actual fixtures proposed for project. Substantiate brightness and efficiency requirements. Photometric data must be produced by a recognized independent laboratory.

1.4 Manufacturer's Operational Test

.1 Test fixtures for acceptance of lamp made to maximum tolerance as required in ANSI standards listed in 16.4-3.

.2 Test fixtures with rated lamps for starting and operation.

.3 Check wiring for agreement with design circuit.

.4 Test for short circuits and improper grounds.

.5 Test operation of fixture and lamp with ballast.

1.5 Samples

.1 Provide samples of all fixtures, lamps, ballasts and accessories when requested.

.2 Where directed, install sample fixtures in a mock-up of specified ceiling to show coordination of fit with ceiling and other equipment i.e., mechanical air diffuser assemblies, wiring channels, brackets, davits and standards. Where pay all costs associated with work of this trade in connection with construction of mock-up, installation and connection of fixtures, lamps, ballasts and accessories.
1.6 Lamps Used for Temporary Lighting

.1 Fluorescent lamps may be used for temporary light and lamps used for this purpose will be accepted when the project or portions of the work are turned over to the Owner. Spot relamp faulty or burned out lamps as identified by the consultant, prior to this acceptance, without additional cost to Owner.

.2 Metal halide, sodium, incandescent and quartz lamps are not to be used for temporary lighting, unless all lamps so used are replaced with new lamps immediately prior to completion at no additional cost to Owner.

2.0 PRODUCTS

.1 Different fixtures may be supplied by different manufacturers. Similar fixtures shall be supplied by the same manufacturer.

.2 Provide only lighting fixtures which are structurally well designed and constructed and which use new parts and materials of highest commercial grade available. Unless otherwise specifically noted, fixtures shall be of the quality stated in the manufacturer’s catalogues and data sheets.

.3 Refer to related sections for details of fixtures and accessories.

.4 Use self-aligning ball joint hangers for rod suspended fixtures.

.5 Use cadmium plated chains for suspended fixtures in unfinished areas.

3.0 EXECUTION

3.1 Installation

.1 Install fixtures in accordance with the manufacturer’s requirements, code requirements, and as shown on the drawings.

.2 Confirm compatibility and interface of other materials with luminaire and ceiling systems. Examine the room finish schedule and reflected ceiling drawings. Report discrepancies and defer ordering until clarified.

.3 Supply plaster frames, trim rings and backboxes to other trades as the work requires.

.4 Ground lighting equipment to a separate grounding conductor.

.5 Coordinate with other trades to avoid conflicts between luminaires, supports and fittings and mechanical and structural equipment.

.6 Provide guards where fixtures are subject to mechanical damage as required by code or shown on the drawings.
3.2 Workmanship

.1 Completely clean all glassware, lamps, and hangers. Polish metal parts before completion.

.2 Provide suitable extension couplings for row mounted fixtures.

.3 Provide reflector alignment clips for row mounted fixtures.

.4 Protect fixtures, hangers, supports, fastenings and accessory fittings at the site prior to and during installation. Unless fixtures are erected immediately, after delivery to site, deliver in original cartons or enclosed in air-tight plastic wrapping. Store in a dry and secure space on site. Protect hangers, supports, fastenings and accessory fittings against corrosion. Take care during installation to ensure that insulation and corrosion protection is not damaged.

.5 Fixtures which show evidence of corrosion, rough handling, scratching of finishes, etc. are to be replaced with new fixtures at no additional cost.

.6 Install recessed fixtures to permit removal from below, for access to outlet or prewired fixture box.

.7 Hang and mount fixtures to prevent distorting fixture frame, housing, sides or lens frame, and permit correct alignment of several fixtures in a row.

.8 Support fixtures as shown on drawings, level, plumb and true with structure and other equipment in horizontal or vertical position as intended. Install wall or side bracket mounted fixture housings rigidly and adjust to a neat flush fit with mounting surface.

.9 Adjust length of hangers of suspended fixtures to hang fixture bodies level and in same horizontal plane, unless shown otherwise on drawings.

.10 Install ceiling canopies to cover suspension attachments and fit tightly to ceiling without restricting alignment of hanger.

.11 For recessed fluorescent fixtures mounted in suspended ceiling with exposed tee bar grid system, support by the ceiling tee bar grid structure. Provide any additional support necessary for oversize fixtures, or to meet code requirements.

.12 Metal inserts, expansion bolts or toggle bolts which do not carry wiring shall be accurately located in relation to outlet boxes, for perfect alignment and spacing of suspension stems or other hangers.

.13 For remote mounted ballasts, supply mounting board and space ballasts in accordance with manufacturer's directions. Size wiring from ballasts to remote fixtures to meet manufacturer's requirements.

.14 Remove any noisy ballasts from the fixtures and replace at no additional cost to the Owner prior to completion.

END OF SECTION
1.0 GENERAL

1.1 Work Included

.1 Supply luminaires complete with lamps and ballasts and all necessary fittings and accessories.

1.2 Reference Standards

.1 All fluorescent lamps provided to comply with the U.S. Environmental Protection Agency’s (EPA) 1990 Toxic Characteristic Leaching Procedure (TCLP) for Low-Mercury content lamps.

.2 Ballasts to meet standards of an electrical testing laboratory and the Certified Ballast Manufacturer’s Association.

.3 Ballasts are to meet the current ANSI and FCC standards.

2.0 PRODUCTS

2.1 Fluorescent Lamps

.1 All fluorescent lamps provided to be compatible with the ballast supplied with the luminaire.

.2 All fluorescent lamps provided to comply with the U.S. Environmental Protection Agency’s (EPA) 1990 Toxic Characteristic Leaching Procedure (TCLP) for Low-Mercury content lamps.

.3 Acceptable Manufacturers:

.1 General Electric
.2 Phillips Lighting Company
.3 or approved alternate.

.4 All fluorescent lamps to be high colour rendition, high efficacy, thermal stability, long life, energy efficient lamps with following minimum requirements:

<table>
<thead>
<tr>
<th>Wattage (Nom. Length)</th>
<th>Lamp</th>
<th>Initial Colour</th>
<th>Lumens</th>
<th>CRI</th>
<th>Related Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 (610mm long)</td>
<td>T8</td>
<td>4100°K</td>
<td>1,400</td>
<td>85</td>
<td>30,000 hrs</td>
</tr>
<tr>
<td>25 (915mm long)</td>
<td>T8</td>
<td>4100°K</td>
<td>2,225</td>
<td>85</td>
<td>30,000 hrs</td>
</tr>
<tr>
<td>32 (1220mm long)</td>
<td>T8</td>
<td>4100°K</td>
<td>2,950</td>
<td>85</td>
<td>30,000 hrs</td>
</tr>
<tr>
<td>Wattage</td>
<td>Lamp</td>
<td>Base</td>
<td>Initial Colour</td>
<td>Lumens</td>
<td>CRI</td>
</tr>
<tr>
<td>---------</td>
<td>---------------</td>
<td>-----------</td>
<td>----------------</td>
<td>--------</td>
<td>-----</td>
</tr>
<tr>
<td>7</td>
<td>PL-S (Short)</td>
<td>G23</td>
<td>4100°K</td>
<td>400</td>
<td>82</td>
</tr>
<tr>
<td>13</td>
<td>PL-C (Cluster)</td>
<td>G24q-1</td>
<td>4100°K</td>
<td>900</td>
<td>82</td>
</tr>
<tr>
<td>18</td>
<td>PL-C (Cluster)</td>
<td>G24q-2</td>
<td>4100°K</td>
<td>1,250</td>
<td>82</td>
</tr>
<tr>
<td>26</td>
<td>PL-C (Cluster)</td>
<td>G24q-3</td>
<td>4100°K</td>
<td>1,800</td>
<td>82</td>
</tr>
<tr>
<td>26</td>
<td>PL-T (Triple)</td>
<td>GX24q-3</td>
<td>4100°K</td>
<td>1,800</td>
<td>82</td>
</tr>
<tr>
<td>32</td>
<td>PL-T (Triple)</td>
<td>GX24q-3</td>
<td>4100°K</td>
<td>2,400</td>
<td>82</td>
</tr>
<tr>
<td>42</td>
<td>PL-T (Triple)</td>
<td>GX24q-4</td>
<td>4100°K</td>
<td>3,200</td>
<td>82</td>
</tr>
<tr>
<td>38</td>
<td>PL-L (Long)</td>
<td>2G11</td>
<td>4100°K</td>
<td>3,300</td>
<td>82</td>
</tr>
</tbody>
</table>

### 2.2 Ballasts for Fluorescent Fixtures

.1 Acceptable Manufacturers:

.1 Advance Transformer Co.
.2 Phillips
.3 Osram Sylvania
.4 Universal Lighting Technologies
.5 or approved equivalent.

.2 General Requirements for Fluorescent Ballasts:

.1 Ballast manufacturer to have been producing ballasts for a minimum of ten (10) years.

.2 Manufacturer to provide a written warranty against material or workmanship defects, which includes defects, for a minimum period of five (5) years from final acceptance of the work.

.3 Ballasts shall provide auto surge protection to withstand line transients as defined in ANSI C62.41 Category A (latest edition).

.4 Ballasts to tolerate sustained voltage and frequency variations of +/-10% without damage to the ballast while maintaining lumen output.

.5 Ballasts to tolerate sustained open circuit and short circuit output conditions without damage.

.6 Ballasts to comply with FCC and NEMA limits covering EMI and RFI and shall not interfere with operation of other normal electrical equipment.

.7 Ballasts must be CSA approved and operate lamps within ANSI C82.11 (latest edition) specifications and meet FCC Rules and Regulations, Part 18 (Class A) and NEMA limits covering EMI and RFI to interfere with operation of other normal electrical equipment.

.8 Lamp Current Crest Factor to be less than 1.7.
.9 Ballasts shall be of the electronic type, operating at voltage indicated in the luminaire schedule, with input frequency of 60 Hz, and lamps operating at frequencies above 42,000 Hz. Ballasts shall be able to sustain 10% voltage or frequency variance from the nominal operating values with no damage and shall tolerate sustained open or short circuit output conditions without damage. Ballasts are to operate up to 70°C case temperature without damage and to have a metal enclosure for optimum thermal performance. No visible lamp flicker to be apparent (<3% flicker index). All ballasts are to be "A" sound rated.

.3 Instant Start Electronic Ballasts

.1 Ballasts to be instant start and to operate lamp(s) as a parallel circuit, providing rated life and rated lumen output of lamps, while allowing independent lamp operation. Remaining lamp(s) to maintain full lumen output if one or more lamps fail.

.2 Power factor shall not be less than 95% and lamp crest factor shall not exceed 1.7 for the ballast.

.3 Minimum ballast factor for primary lamp applications as per ANSI C82.11 to be 0.85 for T8 Lamps and 0.95 for T5 lamps. The maximum ballast factor is not to exceed 1.20.

.4 Total harmonic distortion (THD) of line current shall not exceed 10% of basic phase current for primary lamp applications.

.5 Input watts on 2/32 watt lamp ballast shall not exceed 60 watts at 120 volts.

.4 Rapid Start Electronic Ballasts

.1 Ballasts to be rapid start to operate lamp(s) as a series-parallel circuit providing rated life and rated lumen output of lamps. Lamps are to be provided with independent operation. Remaining lamp(s) to maintain full lumen output if one lamp fails.

.2 Ballast start shall be soft, whereby lamp electrodes are brought to emission temperature (approximately 700°C) before lamp ignition. Pre-heat time shall be approximately 1-2 seconds with a glow current not exceeding 20 milliamps. Transition time for lamp ignition to be approximately 80 milliseconds or less.

.3 Power factor shall not be less than 95% and lamp crest factor shall not exceed 1.7 for the ballast.

.4 Minimum ballast factor for primary lamp applications as per ANSI C82.11 to be 0.85 for T8 Lamps and 0.95 for T5 lamps. The maximum ballast factor is not to exceed 1.20.

.5 Total harmonic distortion (THD) of line current shall not exceed 10% of basic phase current for primary lamp applications.

.6 Input watts on 2/32 watt lamp ballast shall not exceed 65.
.5 Programmed Start Electronic Ballasts

.1 Ballasts to be programmed start to operate lamp(s) as a series circuit providing rated life and rated lumen output of lamps.

.2 Ballast start shall be soft, whereby lamp electrodes are brought to emission temperature (approximately 700°C) before lamp ignition. Filament resistance ratio at ignition (hot) to room temperature (cold) (Rh/Rc ratio) to be above 4.25 for proper thermionic emission. Pre-heat time shall be approximately 1-2 seconds with a glow current not exceeding 20 milliamps. Lamp starting voltage during pre-heat stage to be held at approximately 0 volts. Transition time for lamp ignition to be approximately 30 milliseconds or less.

.3 Power factor shall not be less than 95% and lamp crest factor shall not exceed 1.7 for the ballast.

.4 Ballasts shall have End of Life detection (E.O.L.) for lamps and shutdown circuit.

.5 Minimum ballast factor for primary lamp applications as per ANSI C82.11 to be 0.85 for T8 Lamps and 0.95 for T5 lamps. The maximum ballast factor is not to exceed 1.20.

.6 Compact Fluorescent Electronic Ballasts

.1 Ballasts shall be programmed start to operate lamp(s) as a series circuit providing rated life and rated lumen output of lamps.

.2 Ballast start shall be soft, whereby lamp electrodes are brought to emission temperature (approximately 700°C) before lamp ignition. Filament resistance ratio at ignition (hot) to room temperature (cold) (Rh/Rc ratio) to be above 4.25 for proper thermionic emission. Pre-heat time shall be approximately 1-2 seconds with a glow current not exceeding 20 milliamps. Lamp starting voltage during pre-heat stage to be held at approximately 0 volts. Transition time for lamp ignition to be approximately 30 milliseconds or less.

.3 Power factor shall not be less than 95% and lamp crest factor shall not exceed 1.7 for the ballast.

.4 Ballasts shall have End of Life detection (E.O.L.) for lamps and shutdown circuit.

.5 Minimum ballast factor for primary lamp applications as per ANSI C82.11 to be 0.90 for T4 and T5 lamps. The maximum ballast factor for over driving purposes is not to exceed 1.20.
3.0 EXECUTION

3.1 General

.1 All luminaires (excluding incandescent lamps) are to be "burned-in" at full illumination for a minimum continuous period of 100 hours at initial start-up prior to being dimmed, switched, or de-energized.

.2 Provide ballasts of compatible design to lamps specified.

.3 Integral ballasts to be used with luminaires unless otherwise indicated on the drawings. Remote ballasts identified on the drawings are to be contained within a CSA approved NEMA rated enclosure.

3.2 Disposal of Hazardous Material

.1 Dispose of PCB Ballasts, radioactive material in smoke detectors, PCB capacitors, and PCB transformers in accordance with:

.1 Canadian Environmental Protection Act (Canada).

.2 Canadian Environmental Protection Act - Chlorobiphenyls Regulations (Canada).

.3 Environmental Protection and Enhancement Act (Alberta).

.4 Transportation of Dangerous Goods Act, 1992 (Canada).

.5 Dangerous Goods Transportation and Handling Act (Alberta) and regulations.

.6 Other legislation and regulations which apply to the performance of the work of this section.

.7 Perform work in accordance with the recommendations in the following Environment Canada publications.

.8 Handbook on PCBs in Electrical Equipment by Environment Canada.

.9 Identification of Fluorescent Lamp Ballasts Containing PCBs, EPS 2/CG/2, April 1986, by Environment Canada.

.2 Persons employed for the removal of capacitors and other energized electrical equipment shall be qualified electricians.

.3 Where contact with liquid PCB is possible, personnel shall be instructed in handling procedures, safety precautions, use of safety equipment and applicable Alberta and Federal legislation and regulation.
.4 Handling and transportation of hazardous wastes shall be performed by a company registered as a carrier with Alberta Environment. A listing of such companies may be obtained from the Alberta Environment. Telephone: (780) 427-5883.

.5 Submit proof that all persons involved in handling, packing, loading, transportation, unloading, unpacking and disposal of PCB waste are trained in accordance with the Dangerous Goods Transportation and Handling Act.

.6 Dispose of all radioactive smoke detector components as radioactive waste when, smoke detectors:

.1 Contain 5 microcuries (185 kilobecquerels) or more of Americium-241 or any amount of Radium.

.2 Containing less than 5 microcuries (185 kilobecquerels) of Americium-241 are disposed of in quantities of ten or more.

.7 Dispose of radioactive smoke detector components by making disposal arrangement with one of the following radioactive waste disposal facilities:

.8 Original equipment manufacturer.

.9 Waste Operations Branch

Atomic Energy of Canada Ltd.
Chalk River, Ontario K0J 1J0
Contact: Norm Edwards at (613) 584-3311 for further details.
Atomic Energy of Canada licensed waste disposal facility.

.10 Contact selected radioactive waste disposal facility to obtain their instructions for packaging, labeling and shipping of radioactive smoke detector components.

.11 Package, label and ship radioactive smoke detector components in accordance with waste disposal facility's instructions and in accordance with Alberta and Federal legislation and regulations governing the handling, transportation and disposal of radioactive materials.

3.3 Lamp Disposal

.1 Turn over existing lamps to WCB.

END OF SECTION
1.0 GENERAL

1.1 Related Requirements

.1 Electrical General Requirements: Section 26 05 00.
.2 Wire and Cable: Section 26 10 03.
.3 Conduit for Electrical Systems: Section 26 05 34.
.4 Electrical Equipment and Systems Demonstration and Instruction: Section 26 05 08.

1.2 Product Options And Substitutions

.1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.3 Reference Documents (Latest Editions)

.1 CAN/ULC-S524 Standard for the Installation of Fire Alarm Systems
.2 CAN/ULC-S525 Audible Signal Devices for Fire Alarm Systems
.3 CAN/ULC-S526 Visual Signal Appliances for Fire Alarm Systems
.4 CAN/ULC-S527 Control Units for Fire Alarm Systems
.5 CAN/ULC-S528 Manual Pull Stations for Fire Alarm Systems
.6 CAN/ULC-S529 Smoke Detectors for Fire Alarm Systems
.7 CAN/ULC-S530 Heat Detectors for Fire Alarm Systems
.8 CAN/ULC-S533 Egress Door Securing and Releasing Devices
.9 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems
.10 CAN/ULC-S537 Verification of Fire Alarm Systems
.11 CAN/ULC-S541 Speakers for Fire Alarm Systems, Including Accessories
.12 CAN/ULC-S561 Installation and Services for Fire Signal Receiving Centers and Systems
.13 ABC Alberta Building Code
.14 AFC Alberta Fire Code
.15 NFPA 72 National Fire Alarm and Signal Code
1.4 Description of System

.1 Existing Fire Alarm Control Panel (FACP) is a two stage Notifire 3030 addressable fire alarm system. Install new smoke detectors, heat detectors, fire alarm speakers, etc. as shown on the drawings to accommodate the Tenant Improvements. Update the existing FACP programming as necessary to incorporate the modifications to the fire alarm system.

.2 Fire alarm representative to perform loading calculations confirm whether the existing fire alarm system audio amplifiers have adequate capacity to accommodate both new and existing devices. If necessary, provide a new audio amplifier/transponder that is fully compatible with the existing fire alarm system.

.3 Upgrade existing FACP batteries if required. Fire Alarm representative to perform battery calculations and confirm that there is enough standby battery capacity for both new and existing devices. Batteries to last the twenty-four (24) hours of standby operation and 1/2 hour of alarm operation full load test.

.4 Commission and test modified components with the Engineer.

1.5 Shop Drawings, Product Data, and Samples

.1 Comply with requirements of Section 26 05 00.

.1 Refer to Section 3.5 of CAN/ULC – S524 for details.

.2 Provide complete riser diagram and detail drawings indicating:

.1 All field devices (initiating and notification)
.2 Control units
.3 Component layout
.4 Identification schedule
.5 Detailed wiring connections and wire designations

.3 Provide factory data sheets for the following:

.1 System devices, indicating:

.1 Typical wiring connection
.2 Installation instructions
.3 Control settings
.4 Component limitations

.4 If requested by Minister, submit samples of following components:

.1 Products-of-combustion detector
.2 Thermal detector
.3 Special cables
.4 Audible signaling devices
1.6 **Supplier Qualifications**

.1 System supplier must be an authorized manufacturer’s (Notifier) agent, shall have an office in Edmonton, Alberta established for a minimum of five (5) years, with full in-house technical service and maintenance capabilities. Suppliers utilizing third party or subcontracted maintenance services are not acceptable.

.2 System supplier shall employ factory trained and/or CFAA certified technicians.

1.7 **Source Of Supply**

.1 All fire alarm system components shall be Notifier equipment to match existing on site.

1.8 **Coordination**

.1 Coordinate installation of fire alarm system with:

.1 Existing Notifier Fire alarm System

.2 Fire Alarm System controlled hardware

.3 Mechanical equipment controls (if required)

.2 Coordinate with the above noted work as required to provide a complete, integrated, and functional system.

2.0 **PRODUCTS**

2.1 **Product Manufacturers**

.1 Acceptable fire alarm system manufacturers:

.1 Notifier.
2.2 Addressable Heat Detectors

.1 Addressable thermal fire detectors, self-restoring rate of rise, rate of rise 8.3°C per minute: to CAN/ULC-S530 and as follows.

.1 Features:

.1 Twistlock plug-in base
.2 2-wire operation
.3 LED alarm indicator
.4 Provision for remote alarm

.2 Operation:

.1 Temperature Range: 0°C to 49°C.
.2 Voltage: 15 - 32 V DC.
.3 Supervisory current: 300 microamperes.

.3 Electronics to communicate detector’s status to addressable module/transponder.

.4 Detector address to be set on detector head in field.

.5 To be installed on a standard detector base unless indicated otherwise on the drawings.

2.3 Addressable Photo-Electric Products-Of-Combustion Detectors

.1 Photo-Electric Products-of-Combustion Detectors: to CAN/ULC-S529 and as follows.

.1 Features:

.1 Twistlock plug-in base
.2 2-wire operation
.3 LED alarm indicator
.4 Provision for remote alarm

.2 Operation:

.1 Temperature Range: 0°C to 49°C.
.2 Voltage: 15 - 32 V DC.
.3 Supervisory current: 300 microamperes.

.3 Electronics to communicate detector’s status to addressable module/transponder.

.4 Detector address to be set on detector head in field.

.5 To be installed on a standard detector base unless indicated otherwise on the drawings.
2.4 Speaker STROBES

.1 Speakers: to CAN/ULC-S541 and as follows.

.1 Voltage: 25V RMS or 70.7V RMS.

.2 Mounting: ceiling or wall mount complete with backbox, or as indicated on the drawings.

.2 Shall operate with field selectable output taps from 0.5 to 2.0W. Speakers shall provide a minimum sound output of 80 dBA at 10 feet (3,000 mm) with the 1/2 watt tap.

.3 Frequency response shall be a minimum of 600 HZ to 4,000 HZ.

.4 All strobes to be synchronized at one (1) flash per second. Adjust candela settings to ensure proper coverage of strobe signal. Speaker/strobes should match the make and manufacture of the existing devices, is possible. Adjust sound volume settings to ensure proper coverage of audible signal.

.5 Provide individual strobe units where indicated on drawings.

.2 Synchronized Strobes throughout.

.5 New fire alarm speakers to match the existing fire alarm speakers.

2.5 MASS NOTIFICATIONS STROBES

.1 Speaker Strobes: ULC approved.

.1 Voltage: 12V or 24V.

.2 Mounting: ceiling or wall mount, plug in design for simplified installation or as indicated on the drawings. All strobes to be synchronized at one (1) flash per second.

.2 Shall operate with field selectable output candelas from 15 to 185.

.3 Combination speaker/strobe units to be 24 VDC, wall or ceiling mount multi-candela type. All strobes to be synchronized at one (1) flash per second. Adjust candela settings to ensure proper coverage of strobe signal. Speaker/strobes should match the make and manufacture of the existing devices, is possible. Adjust sound volume settings to ensure proper coverage of audible signal.

.4 New mass notification devices to match the existing on-site.
2.6 End-Of-Line Resistor Assembly

.1 End-of-line Resistor Assembly: single gang steel plate, terminal strip on back, resistor, red enamel finish and laminoid nametag on front identifying zone.

2.7 Wire And Cable

.1 Cable types and sizes to meet the requirements of CAN/ULC-S524 and the Canadian Electrical Code, and be in accordance with the manufacturer's recommendations.

3.0 EXECUTION

3.1 Installation

.1 Install system in accordance with CAN/ULC-S524.

.2 Mount end-of-line resistors in accordance with CAN/ULC-S524 and the Canadian Electrical Code.

.3 Panel Wiring:

.1 Make conductor terminations in panel on terminal strips with separate terminal for each conductor.

.2 Neatly install wiring clamped with nylon cable straps or laced with jute cord.

.3 Number identify all strips as indicated on shop drawings.

.4 Attach wiring diagram to inside of panel door.

.4 Field Wiring:

.1 Initiation

.1 Maintain existing data communication link (DCL) wiring style when adding new devise or relocating existing devices. Avoid parallel tapping (T-Tapping) of circuits.

.2 Provide fault isolation modules where required by CAN/ULC-S524.

.2 Speaker Circuits

.1 Speaker circuits shall be Class B.

.2 Speaker wiring shall be shielded.

.3 Parallel tapping (T-Tapping) of circuits is not permissible.

.3 General

.1 Size, quantity and wire type to be per manufacturer's instructions. Do not reduce minimum wire sizes stated in specifications.

.2 Confirm wiring requirements during tender period with manufacturer and make suitable allowances.
3.2 Testing And Verification

.1 Verify completed system in accordance with requirements of CAN/ULC-S537.

3.3 Demonstration And Instruction

.1 Comply with requirements of Section 26 05 08.

END OF SECTION