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November 3, 2023

Addendum No. 01

File Reference Number: RFP 2023 048

Title: North Bay Diesel Shop Washroom Upgrades & First Aid Room

RE: Clarifications/Questions

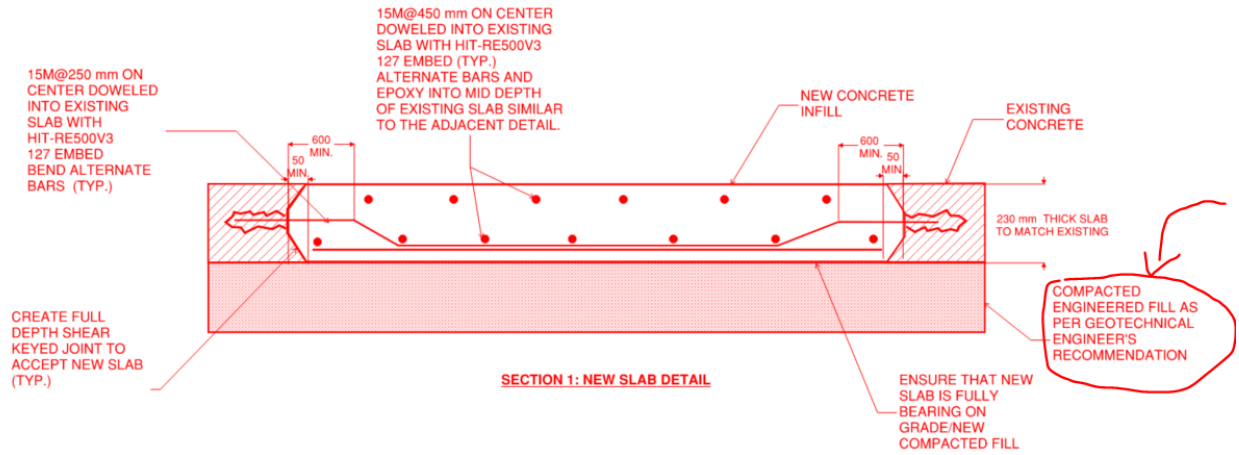
Please refer to the following information / clarifications:

Item 1: In the Structural Memo dated March 22, 2023, relating to slab removals, the detail below is provided and it references geotechnical recommendations that are to be followed. I don't see these listed as being provided with the RFP documents, but I could be mistaken .

Please provide them if they weren't provided or indicate where they are provided in the RFP documents.

Answer: We do not have a geotechnical report for this area.

Item 2:



Please confirm the intent of the notes above relating to engineered fill. Is the intent to simply excavate for new underground rough ins and backfill with gravel after completed and potentially re-using the existing granules? Or is new engineered fill required in this area and if so, please

confirm the thickness and type of material. Since this job is being done over the winter, we want to source early.

Answer: The intention of the structural memo is to specify how the under-slab will be treated once the slab is removed. We suspect the supporting/compacted material may have eroded over time under this area so the memo is simply to provide guidance as to how the condition can be addressed, once uncovered. The unknown is that we do not know to what extent the deterioration under the slab has gone.

Item 3: Please confirm that there is no separate specification for the electrical work and that they are part of the electrical drawings.

Answer: Yes, there is a specification booklet (20230915 ONTC Washroom IFT Spec attached) that was provided with the tender documents. Please see the document attached once again. The electrical work can be referenced from both the consultant drawings and specifications.

Item 4: For the temporary toilets that ONTC requires, please provide details for these toilets. Quantity and type of fixtures, AODA compliant? Including barrier free access? Location of facilities and who does the cleaning etc.? This will be discussed during the walkthrough. The operations team will determine the need, quantities, and the percentage split between males and females.

Answer: These are simply temporary portable washrooms that will be placed on the exterior. Handicap accessibility will not be a consideration.

Item 5: Can as built information of existing underground services be provided at the new washroom region?

Answer: Yes, please see the attached. These are the only drawings we have on file:

1 – Diesel_Shop_Scans - 20170228

Regards,

Ashley Commanda
Manager, Public Procurement
Ashley.Commanda@ontarionorthland.ca

705-472-4500 ext. 398

AECOM

Ontario Northland Transportation Commission

Design Washroom Renovation

Project No: 60670556
Issued for Tender – August 17, 2023

Project Manual

Volume 1

Division 02 to 23

Delivering a better world

1.1 OWNER:

915 McIntyre Street East,
North Bay
Ontario, P1B 1G2

1.2 PROFESSIONAL SEALS AND SIGNATURES

ARCHITECT (A) OF RECORD:

Gabriel Colombani
Architect of Record

March 22, 2023
Date

STRUCTURAL (S) ENGINEER OF RECORD:

Laith B. Hajsaid
Structural Engineer of Record

March 22, 2023
Date

MECHANICAL (M) ENGINEER OF RECORD:

Marc Gregoire
Mechanical Engineer of Record

March 22, 2023
Date

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Review drawings, site conditions, and other specification sections to ascertain the extent and nature of work of this section.

.2 The Work of this Section includes the following:

.1 Demolish and removal of portions of existing concrete slab, and roofing materials, as indicated on drawings.

.2 Disconnect/cap existing service in areas of demolition.

.3 Dispose of demolished materials except where required to be salvaged or reused.

.4 Refer to demolition notes indicated on drawings.

.3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American National Standards Institute (ANSI):

.1 ANSI A10.8, Scaffolding Safety Requirements

.3 Canadian Standards Association (CSA):

.1 CSA S350, Code of Practice for Safety in Demolition of Structures.

.4 National Fire Protection Association (NFPA):

.1 NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations

.5 Provincial Legislation:

.1 Legislation specific to Authority Having Jurisdiction for work governed by this Section

1.4 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.

.5 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

1.5 EXAMINATION

.1 Visit and examine the site and note all characteristics and irregularities affecting Work of this Section. Submit a pre-demolition inspection report. Ensure the Owner of premises being inspected is represented at inspection.

.2 Where appropriate prepare a photographic or video record of existing conditions, particularly of existing work scheduled to remain.

.3 Where applicable, examine adjacent tenancies not part of the scope of work. Determine extent of protection required to areas and related components not subject to demolition.

.4 Stop work and notify the Consultant should suspected hazardous materials are encountered during work of this Section.

1.6 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Prepare schedule in conjunction with overall project schedule, and outline proposed methods in writing. Obtain approval before commencing demolition work, and indicate the following:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity

.2 Interruption of utility services

.3 Coordination for shutoff, capping, and continuation of utility services

.2 Submit drawings for demolition of structural elements bearing the seal of a professional engineer licensed to design structures and registered in the Province of Ontario.

1.7 QUALITY ASSURANCE

.1 Conform to requirements of all authorities having jurisdiction.

.2 Comply with applicable requirements of CSA S350 Code of Practice for Safety in Demolition of Structures".

.3 Work of this Contract shall be executed by an approved company having a minimum of five (5) years continuous experience and able to deploy adequate equipment and skilled personnel to complete work expediently in an efficient and orderly manner.

.4 Perform cutting and coring, where applicable, by a firm specializing in this type of work, able to produce evidence of successful completion of similar work over a period of at least five (5) years immediately prior to date of contract.

.5 Apply for, secure, arrange and pay for all permits, notices and inspections necessary for proper execution and completion of work in this Section.

.6 Professional Engineer Qualifications: Procure the services of a professional engineer who is experienced in providing relevant engineering services to perform the following:

.1 Review portions of the Work requiring structural performance, prepare plan of action, engineer temporary shoring and bracing, and Provide site administration and inspection for work of this Section.

1.8 PROTECTION

.1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety and support of such work. Be liable for any such movement or settlement, and any damage or injury caused.

.2 Cease operations and notify Consultant if safety of any adjacent work or structure appears to be endangered. Take all precautions to support the structure. Do not resume operations until reviewed with the Consultant.

.3 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems which remain in operation.

.4 Temporarily suspended work that is without continuous supervision shall be closed to prevent entrance of unauthorized persons.

1.9 REMAINING AND ADJACENT STRUCTURES

.1 Do not interfere with, encumber, endanger or create nuisance, from any cause due to demolition work, to public property or any adjacent attached and/or detached structures in possession of Owner or others, which are to remain, whether occupied or unoccupied during this work.

.2 Make good damage to such structures resulting from work under this Section at no cost to Owner. Make good adjacent building surfaces damaged by work of this Section.

1.10 PROTECTION OF SERVICES AND STRUCTURES

.1 Take necessary precautions to guard against movement, settlement or collapse of existing adjacent utility services, public property and/or structures, whether to remain or not. If these or other unforeseen conditions develop, take immediate emergency measures, report to Consultant, confirm in writing, and await instructions before proceeding with any further related demolition work.

.2 Prior to saw cutting or core drilling of existing concrete slabs, use ground penetrating radar (GPR) to detect utilities and structural reinforcing. Concrete X-Rays can be used when access to both sides of concrete slab is accessible for placement of required x-ray film.

1.11 EXISTING SERVICES

.1 Prior to start of demolition disconnect all electrical and telephone service lines in the areas to be demolished. Post warning signs on all electrical lines and equipment which must remain energized to serve other areas during period of demolition. Disconnect electrical and telephone service lines in demolition areas to the requirements of local authority having jurisdiction.

.2 In each case, notify the affected utility company in advance and obtain approval where required before commencing with the work on main services.

.3 Arrange with utility companies for locating of such services and for disconnection of existing services owned by utility companies and which will be disconnected by said utility companies, provided such services do not interfere with adjacent tenancy operators.

.4 Remove sewer and water lines where required within existing building as deemed necessary, and cap to prevent leakage, in accordance with authorities having jurisdiction.

.5 Existing services are to be maintained where required for normal tenant operation during regular hours of operation and/or as deemed necessary by Owner.

1.12 EXISTING WARRANTIES

.1 Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

2 Products

2.1 DEBRIS MATERIAL AND EQUIPMENT DISPOSAL

.1 All materials and or equipment from demolition work becomes property of demolition Contractor unless designated otherwise.

.2 At no cost to Owner repair or replace material and/or equipment scheduled to remain which is damaged by demolition work. Do not sell any material or equipment directly from project site.

.3 Remove waste debris continually and entirely from project site during demolition work. Do not load vehicles transporting such debris beyond their safe capacity or in a manner which might cause spillage on public or private property. If spillage does occur, clean up immediately to prevent traffic hazards or nuisance.

2.2 PROTECTION

.1 Temporary Protection:

.1 Erect temporary hoarding protection, as indicated to enclose openings in exterior walls, and/or provide security to partially occupied interior spaces.

.2 Erect temporary dust screens, as indicated to prevent dust and debris to enter areas of the building which are not scheduled for demolition. Remove temporary dust screens when no longer required.

2.3 REPAIR MATERIALS

.1 Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Use a material whose installed performance equals or surpasses that of existing material.

.3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Floor Patching and Levelling Compounds: Use cement based, trowelable, self-levelling compounds compatible with specified floor finishes; do not use gypsum based products for work of this Section.

.3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.

2.4 EXISTING MATERIALS

.1 Item to be retained for re-use in new construction include, but are not limited to the following:

.1 Treatment Table.

.2 Items to be coordinated with the Owner for re-use in new construction include, but are not limited to the following:

.1 Medical Mobile Cart.

.2 First-aid Cabinet.

.3 Office Desk and Chair

.4 Storage Cabinet.

3 Execution

3.1 GENERAL

.1 Exercise caution in dismantling, disconnecting of work adjacent to existing work designated to remain.

.2 Carry out demolition in a manner to cause as little inconvenience to the adjacent properties as possible.

.3 Carry out demolition in an orderly and careful manner.

.4 Demolition by explosives is not permitted.

.5 Selling or burning of materials on site is not permitted.

.6 Sprinkle exterior debris with water to prevent dust. Do not cause flooding, contaminated run-off or icing. Do not allow waste material, rubbish, and windblown debris to reach and contaminate adjacent properties.

.7 Lower waste materials in a controlled manner; do not drop or throw materials from heights.

.8 At end of each day's work, leave in safe condition so that no part is in danger of toppling or falling.

3.2 SAFETY AND SECURITY

.1 Maintain security of the building at all times during demolition work.

.2 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.3 ACCESS ROUTES

.1 Restrict operations to designated access routes.

.2 Do not obstruct roads, parking lots, sidewalks, hydrants and the like.

3.4 SELECTIVE DEMOLITION

.1 Provide necessary shoring and supports to assure safety of structure prior to cutting and coring.

.2 Where practical, sawcut and remove material as required.

.3 Where sawcutting is not appropriate, use suitable hand tools.

.4 Demolish, cut-out and remove from site all other work noted on drawings or required to permit new construction.

.5 Do not allow water to accumulate or flow beyond work area. Provide receptacles and mop-up as work proceeds.

.6 Demolish existing flooring and wall finishes, and adhesive remnants as follows:

.1 Floor and wall substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through new flooring and wall finishes.

.7 Demolish completely all ceiling panels and grid as indicated.

.8 Remove all wall coverings scheduled for demolition. Patch and repair wall surfaces with skim coat of gypsum board joint compound leaving wall surfaces smooth and even ready for new wall finishes.

.9 Drainage and Sewer System Protection:

.1 Ensure that no dust, debris or slurry enters drainage and sewer system on Site.

.2 Remove and dispose of debris and slurry promptly from Site.

.3 Comply with Metro Sewer Use By-Law.

.10 Ceilings:

.1 Where ceiling and support components are to be demolished:

.1 Remove ceiling panels, grids, suspension and support components.

.11 Tiles:

.1 Where wall and floor tiles are to be demolished, unless indicated otherwise, remove entire to grout joint as indicated on the Contract Drawings.

.1 Removal of tile setting bed.

.2 Stripping of adhesives, underlayment, or other cleavage membranes.

.3 Sweep and vacuum area.

.4 Apply floor patch throughout the floor area to eliminate pitting and fill existing saw cuts or expansion joints within the concrete slab. Patching compound to be compatible with new finishes.

.5 Sand down the patch to a smooth finish and ready for new finishes.

.12 Terrazzo:

.1 Where terrazzo is scheduled to be removed unless indicated otherwise, removal includes the following:

.1 Removal of setting bed.

.2 Removal zinc divider strips and base screeds.

.3 Removal of terrazzo topping and bases.

.4 For interior slabs-on-grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions.

.2 Doors and Hardware:

.1 Where doors are scheduled to be removed unless indicated otherwise, removal to include, but not limited to the following:

.1 Removal of door panel, door frame and hardware.

3.5 PATCHING AND REPAIRING

.1 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.1 Prepare existing surfaces schedule to receive new finish by grinding, filling, over-coating, stripping, washing, etching, shot blasting or other chemical or mechanical means, as required to ensure satisfactory installation of new finish.

.2 Floors and Walls:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide an level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Patch any existing areas adjoining / adjacent to new construction in good workmanship, filling and finishing gaps between finishes to allow new work to blend seamlessly with existing work.

.7 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

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

3.6 EXCESSIVE DEMOLITION

.1 Where excessive demolition occurs, be responsible for cost of replacing such work.

.2 Consultant shall determine extent of such 'over-demolition' and method of rectification.

3.7 COMPLETION

.1 Leave project site as directed, reasonably clean and presentable, free from above grade debris, any salvaged material and/or equipment except those designated to remain.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete formwork and falsework installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 20 00 - Concrete Reinforcing

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

.3 Section 07 92 00 - Joint Sealants

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA O86-09, Engineering Design in Wood

.3 CSA O121-08, Douglas Fir Plywood.

.4 CSA O151-09, Canadian Softwood Plywood.

.5 CSA O153-M1980, Poplar Plywood.

.6 CSA O325-07 (R2012), Construction Sheathing.

.7 CSA O437 Series-93, Standards for OSB and Waferboard.

.8 CSA S269.1-1975 (R2003), Falsework for Construction Purposes.

.9 CAN/CSA-S269.3-M92 (R2013), Concrete Formwork.

.10 CSA-S413-07, Parking Structures

.2 American Concrete Institute (ACI):

.1 ACI 347-04, Guide to Formwork of Concrete.

.3 National Lumber Grades Authority (NLGA):

.1 Standard Grading Rules for Canadian Lumber, 2010.

1.4 DEFINITION

.1 Architectural Concrete — Concrete that is exposed as an interior or exterior surface in the completed structure that contributes to the visual character of the completed structure.

1.5 DESIGN REQUIREMENTS

.1 Design formwork in accordance with CSA S269.1, CAN/CSA S269.3-M and CSA A23.1 Clause 6.5 – Formwork. For Architectural Concrete, provide formwork that conforms to the requirements of CSA A23.1 Clause 8.3.4 – Formwork for Special Architectural Finishes.

.2 Design and engineer falsework and formwork including shoring and bracing to resist loads due to wet concrete, forms, wind, dead loads, construction live loads and forces arising from use of equipment to place concrete without differential settlement between them and to ensure finished concrete within the tolerances required by CSA-A23.1/A23.2.

.3 Design forms for concrete exposed to view or to carry finish, with maximum deflection of 1/400th of span.

.4 When high range water reducer (superplasticizer) is used in concrete mix, design forms for full hydrostatic pressure.

.5 Make joints in forms watertight.

.6 Design formwork to meet variations from a reference system specified in CSA A23.1 Clause 6.4.6.

1.6 SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate the method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and comply with CAN/CSA S269.3-M for formwork drawings.

.2 Shop drawings shall indicate:

.1 Layout of panel joints, and tie hole pattern.

.2 Method of sealing form tie hole.

.3 Coordinate with details where shown on the Contract Drawings.

.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

.4 Indicate sequences of erection and removal of formwork/falsework.

.5 Include full details and locations of splices.

.6 Each shop drawing submission shall be stamped and signed by a qualified professional engineer licensed to practice in the Province of Ontario.

.3 Product Data:

.1 Submit the manufacturer's Product data sheets including materials, allowable loading, installation, application and maintenance, and instructions for the applicable items listed:

.1 Proprietary scaffolding.

.2 Shoring beams.

.3 Lumber for formwork and falsework.

.4 Plywood for formwork and falsework.

.5 Tubular column forms.

.6 Form release agent.

.7 Form ties.

.8 Manufacturer's details and specifications for proprietary materials used in formwork liners and coatings.

.4 Submit one sample for each of the following items:

.1 Form ties.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOCs.

2 Products

2.1 MATERIALS

.1 For concrete with special architectural features, use formwork materials in accordance with CSA A23.1/A23.2.

.2 Plywood: CSA O121, G1S; Douglas Fir plywood, sheets as large as practical, minimum 19 mm thick, seven ply, exterior grade, waterproof glue, edges sealed with oil based sealer.

.3 Prefabricated steel forms: CSA S136; Free of irregularities, dents, sags, rust, and materials that can discolour concrete finish

.4 Steel forms: seamless, steel plates, internally treated with release material.

.5 Tubular column forms: Round, spirally wound laminated fibre forms free of dents and other irregularities, complete with seamless plastic liner, internally treated with form release agent.

.6 Form ties:

.1 For concrete not designated 'Architectural Concrete', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

.2 For Architectural Concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.3 Wire ties shall not be permitted.

.7 Form release agent: Quick drying, sprayable, non-staining, non-toxic coating, compatible with paint and mortar, VOC compliant, containing compounds that react with free lime present in concrete forming water insoluble soaps, preventing concrete from sticking to forms.

.1 Eucoslip VOX by The Euclid Chemical Company;

.2 Clean Strip Ultra (J-3 VOC) by Dayton Superior Corp.;

.3 Sealtight Duogard II by W.R. Meadows of Canada Ltd.;

.4 Debond Form Coating by L&M Construction Chemicals Inc. Buffalo., N.Y.

.8 Chamfer strips: 20 x 20 mm triangular fillets milled from clear, straight grain pine, surfaced each side, or extruded vinyl type, with or without nailing flange.

.9 Falsework materials: in accordance with CSA S269.1.

.10 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions are consistent with the Contract Drawings.

.2 Obtain approval from the Consultant for the use of earth forms framing openings not indicated on the Drawings.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within the tolerances required by CSA-A23.1/A23.2.

.5 Do not place shores and mud sills on frozen ground.

.6 Provide Site drainage to prevent the washout of soil supporting mud sills and shores.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise in the Contract Documents.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated on the Contract Drawings.

.10 Construct forms for Architectural Concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.11 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Clean formwork in accordance with CSA-A23.1/ A23.2, before placing concrete.

3.2 REMOVAL AND RE-SHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 4 Days for walls.

.2 7 Days for columns.

.3 Until concrete has reached 70% of its compressive strength and not before seven 7 Days for beams, slabs, decks and other structural members. Re-shore concrete with adequate shoring to standards specified for 14 additional Days.

.2 Provide all necessary re-shoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.3 Space re-shoring in each principal direction at not more than 3,000 mm apart.

.4 Re-shoring shall remain until concrete has reached its 28-Day designed compressive strength.

.5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.3 CONSTRUCTION JOINTS

.1 Obtain approval from the Consultant for location and details of construction joints shown a minimum of two weeks prior to start formwork.

3.4 EXPANSION AND CONTROL JOINTS

.1 Construct expansion and control joints at the locations indicated and in accordance with the details shown on the Contract Drawings.

.2 Construct clean expansion joints free of foreign material, likely to impair the proper operation of the joint.

.3 Provide a non-extruding joint filler in expansion joints for the full area between adjacent concrete members. Anchor the filler material to one of the adjacent members or between concrete members and adjacent members of other materials.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete concrete reinforcing installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Formwork and Falsework

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CSA A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

.2 CAN/CSA A23.3-04, Design of Concrete Structures.

.3 CAN/CSA G30.18-M92, Billet Steel Bars for Concrete Reinforcement.

.4 CSA S413-07, Parking Structures.

.5 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures.

.6 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction

.2 Ontario Provincial Standard Specification (OPSS):

.1 OPSS 905, Construction Specification for Steel Reinforcement for Concrete.

.3 ASTM International:

.1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

.2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.3 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, For Concrete.

.4 Reinforcing Steel Institute of Canada (RSIC):

.1 RSIC, Reinforcing Steel Manual of Standard Practice (2004).

.5 International Conference of Building Officials (ICBO):

.1 ICBO Research Report.

1.4 QUALITY ASSURANCE

.1 Welder Qualifications: CSA W47.1 and CSA W186 certified.

1.5 SUBMITTALS

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

.2 Shop Drawings:

.1 Submit reinforcement drawings prepared in accordance with the RSIC Manual of Standard Practice.

.2 Design and detail lap lengths to CAN/CSA A23.3. Supply Class B splices unless shown otherwise on the Contract Drawings. Splices are to be staggered unless otherwise shown on the Contract Drawings.

.3 Submit placing drawings, bar lists, quantities and bar bending details. Bar bending details shall include details of standard bends. Indicate the name of the bent bar fabricator, name of bulk steel supplier and steel grade.

.4 On placing drawings, indicate bar sizes, spacing, location and quantities of reinforcement, splices, splice lengths, location of expansion, control and construction joints, with identifying code marks to permit correct placement without reference to structural drawings. Indicate the sequence of placing concrete. Indicate type, sizes, spacings and locations of chairs, spacers and hangers.

.5 If bar list and bending schedule contain details of bars of more than one reinforcing bar placement drawing, then arrange bar marks in separate groups for each placement drawing. Clearly indicate for each bar mark the corresponding reinforcing bar placement drawing number.

.6 For slabs, show a separate plan indicating concrete thicknesses, reinforcing bars, and dowels for walls and columns cast in slab.

.7 For walls, show separate elevations indicating concrete thicknesses, reinforcing bars, and dowels for slabs and adjacent walls cast in wall.

.8 Show position and size of openings in slabs and walls. Cooperate with trades requiring openings to ascertain necessary information.

.9 Do not add new information on previously reviewed shop drawings.

.10 Reinforcing bar placement shop drawings will be reviewed for bar sizes, locations, and spacing, and will be stamped and signed. Bar list and bending schedule will not be reviewed or stamped.

.11 Submit shop drawings of dowel bar splicers, detailing locations, sizes, and types.

.12 Substitution of different size bars may be permitted upon written acceptance of the Consultant.

.13 Reproduction of the Contract Drawings for use as shop drawings is not permitted. Do not use Contract CADD files.

.3 Product Data Sheets:

.1 Submit three copies of the manufacturer's Product data sheets including installation and maintenance instructions for: chairs, bolsters, bar supports, and side form spacers, dowel bar splicers, and mechanical splices.

.4 Test Reports:

.1 Submit certified copies of mill test reports for reinforcing steel and welded wire fabric, showing physical and chemical analysis, a minimum of 30 Days prior to commencing the Work. Determine physical and chemical properties of steel reinforcing in accordance with requirements of CSA-G30.18.

.5 Certificates:

.1 Submit welding certificate in accordance with CSA W47.1 and CSA W186-M.

.6 Information Submittals:

.1 Submit in writing the proposed source of reinforcement material to be supplied.

.2 Dowel Bar Splicers:

.1 Verification that device threads have been tested and meet the requirements for thread quality, in accordance with the manufacturer's published methods.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 60 00 – Product Requirements and with the manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to Site in original factory packaging, labelled with the manufacturer's name and address.

.3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists. Clearly indicate mill run for which bars were fabricated.

.4 Storage and Handling Requirements:

.1 Store reinforcing steel off the ground and kept free of mud, dirt, oil and any contaminants which may adversely affect performance of reinforcing steel. Comply with CSA A23.1/A23.2.

.2 Store welded wire fabric sheets flat and off the ground.

.3 Deteriorated or contaminated materials will be rejected and shall be removed from site.

.4 Replace defective or damaged materials with new materials at no additional cost to the Owner.

2 Products

2.1 MATERIALS

.1 Substitution of different size bars may be permitted upon written acceptance of the Consultant.

.2 Reinforcing Bars:

.1 Reinforcing steel: CAN/CSA G30.18-M; Carbon-steel bars, deformed unless indicated otherwise in the Contract Documents, Grade 400R.

.2 Weldable reinforcing steel: CAN/CSA-G30.18-M; Weldable low alloy steel bars, where welding of reinforcing bars is indicated in the Contract Documents, deformed, Grade 400W.

.3 Plain round reinforcing steel: CAN/CSA G30.18-M; round, Grade 400R, for expansion joints.

.4 Do not substitute with epoxy-coated bars.

.3 Welded steel wire fabric: ASTM A82/A82M; Resistance welded in size and spacing shown for smooth wire fabric and ASTM A497/A497M for deformed wire fabric, in flat sheets only.

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M, minimum 1.6 mm diameter, with coating for use with uncoated and coated reinforcing steel.

.5 Bar Supports and Spacers:

.1 Adequate for accurate placing and as required for construction loads.

.2 Provide non-conductive bar supports in contact with exposed surfaces that has geometry and bond characteristics that prevents moisture movement from the surface to the reinforcement.

.3 In beams, columns, walls, and slabs exposed to view after form removal: Small concrete blocks made up of same color and strength as concrete being placed around them.

.4 Do not use plastic or stainless steel bar supports or side form spacers.

.5 Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports are not high or strong enough.

.6 Mechanical Splices:

.1 Mechanical Threaded Connections: Furnish metal coupling sleeve with internal threads engaging threaded ends of bars, capable of developing in tension or compression 125 percent of yield strength of bar.

.1 Conform to CSA A23.3.

.2 Provide a thread-in plastic plug to protect the threads.

.3 Wrap exterior with tape.

.4 Clip the mounting washer, if provided, to maintain cover without displacing the bar.

2.2 FABRICATION

.1 Fabricate and bend reinforcing steel in accordance with CAN/CSA-A23.1/A23.2, RSIC Manual of Standard Practice and in accordance with the accepted placing drawings.

.2 Reinforcing Bars:

.1 Use longest bar possible.

.2 Shear and bending Tolerances:

.1 Length: ±25 mm.

.2 Outside dimensions of stirrups, ties, and spirals: ±13 mm.

.3 Other bends: ±25 mm.

.4 Where increases cause interference with waterstop- plus 0 mm.

.5 Ensure cutting and bending tolerances are sufficiently accurate to comply with placing tolerances shown.

.3 Keep number of splices to a minimum.

.4 Do not weld chairs, bolsters, bar supports, or spacers to reinforcing bars.

.3 Reinforcing Splices:

.1 Lap Splices: Splice by lapping reinforcing bars, unless specified otherwise in the Contract Documents.

.2 Welded Splices: Full penetration direct butt splice welds in accordance with CSA W186 and as specified in the Contract Documents.

.3 Splices in Wire Fabric: Comply with CSA A23.3.

.4 Obtain prior written approval from the Consultant for locations of reinforcement splices other than those shown on the placing drawings.

.4 Bend bars cold, heating of bars will not be permitted.

.5 Verify elevations before cutting and bending reinforcing bars.

.6 Obtain written approval from the Consultant prior to welding reinforcement. Weld reinforcement in accordance with CSA W186-M.

3 Execution

3.1 PREPARATION

.1 Notify Consultant a minimum one week in advance of when reinforcing is ready for inspection.

.2 Clean reinforcing bars of loose rust, mill scale, dried cement paste, mud, oil, or other coatings that will affect adhesion in accordance with CSA A23.1/A23.2, Clause 6.1.5 – Surface Condition of Reinforcement, prior to placing concrete.

.3 Coat wire projecting from bar supports with dielectric material or plastic.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement without prior written approval by the Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure. Required radius of bend shall be provided in accordance with CSA A23.4.

.3 Replace bars which develop cracks or splits.

3.3 REINFORCEMENT BAR INSTALLATION

.1 Prior to installation of reinforcing steel, inspect installed Work of other trades and verify that Work is complete for installation of reinforcement.

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

.3 Use plain round bars as slip dowels in concrete.

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

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

.4 Tie bars at least at every fourth intersection minimum. Make maximum untied length 1000 mm.

.5 Do not eliminate or displace reinforcement to accommodate hardware to be embedded in concrete.

.6 Do not field bend bars partially embedded in concrete except as shown on the Contract Drawings or as accepted by the Consultant.

.7 Prior to placing concrete or closing wall and column forms, obtain acceptance of reinforcing steel and position from Consultant.

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

.9 Splicing:

.1 Use lap splices, unless otherwise shown on the Contract Drawings or permitted in writing by the Owner’s Representative.

.2 Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar in tension and compression.

.3 Stagger splices in adjacent bars.

.10 Dowel Bar Splicers:

.1 Use only in areas specifically approved in writing by the Owner’s Representative.

.2 Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICBO Research Report.

.3 Install dowel bar splicers with plastic setting plugs.

.4 Lightly grease internal threads in accordance with manufacturers printed instructions.

.5 Maintain minimum edge distance and concrete cover as noted in the Contract Drawings.

.11 Mechanical Splices:

.1 Install mechanical splices in accordance with the manufacturer's written instructions. Request the presence of the manufacturer's representative to verify proper installation.

.12 Tying Reinforcing Bars:

.1 Bend tie wire away from concrete surface. Ensure that the cover for tie wires, form tie bolts, etc. are the same as the reinforcing bars. Do not let reinforcing tie wire touch formwork or be exposed in the finished concrete structure.

.13 Reinforcement Around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut or disrupted for opening. Extend steel reinforcing a standard lap length beyond opening at each end.

.14 Welding Reinforcement:

.1 Only Type W bars may be welded.

.2 Do not perform welding until welder qualifications are approved.

.15 Do not field cut reinforcement except where indicated or authorized in writing by the Consultant.

3.4 PROGRESS CLEANING

.1 Leave the Work areas clean at end of each Working Day.

.2 Final Cleaning: Upon completion of reinforcing steel installation, remove surplus materials, rubbish, tools and equipment and verify that the area ready for placing concrete.

END OF SECTION

1 General

1.1 SUMMARY

.1 Supply all labour, materials, equipment, services and perform all operations required to complete cast in place concrete installation.

1.2 RELATED REQUIREMENTS

.1 Section 03 10 00 - Concrete Formwork and Falsework

.2 Section 03 20 00 – Concrete Reinforcing.

1.3 REFERENCES

.1 CSA International:

.1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000-13, Cementitious materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.4 CAN/CSA-G30.18-09: Carbon Steel Bars for Concrete Reinforcement.

.5 CSA S413-07, Parking Structures

.2 ASTM International:

.1 ASTM C260-06, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-11, Standard Specification for Chemical Admixtures for Concrete.

.4 .ASTM C1017/C1017M-07, Standard specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D1751-04 (2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.6 ASTM C1059/C1059M-99 (2008), Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

.7 ASTM D6690-07, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

.8 ASTM D1752-04a (2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.9 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.

.10 ASTM D412-06, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension.

.11 ASTM C109/C109M-13, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars using 50-mm Cube Specimens

.12 ASTM C1315, Standard Specification for Liquid Membrane-Forming Compound having Special Properties for Curing and Sealing Concrete

.3 American Concrete Institute (ACI):

.1 304.2R Placing Concrete by Pumping Methods

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

.2 CAN/CGSB 51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.4 ABBREVIATIONS AND ACRONYMS

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.

.2 Type MS or MSb – Moderate sulphate-resistant cement.

.3 Type MH or MHb - Moderate heat of hydration cement.

.4 Type HE or Heb - High early-strength cement.

.5 Type LH or LHb - Low heat of hydration cement.

.6 Type HS or HSb – High sulphate-resistant cement.

.2 GGBFS - Ground, granulated blast-furnace slag.

1.5 DEFINITIONS

.1 Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures including surfaces above water.

.2 Surface Defects: Surface areas that include honeycomb, rock pockets, indentations greater than 5 mm, cracks 0.25 mm wide and larger, spalls, chips, air bubbles greater than 20 mm in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form pop outs, texture irregularities, and stains and other colour variations that cannot be removed by cleaning.

.3 Defective concrete: As defined in subsection 1.5.6 – Defective concrete, below.

.4 New Concrete: Less than 60 Days old.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 40 00 – Quality Requirements.

.2 Ready Mixed Concrete Producer: Certified member in good standing of the Ready Mixed Concrete Association of Ontario.

.3 Inspection and tests:

.1 Materials: CSA A23.1/A23.2.

.2 Tests will be performed in accordance with CSA A23.1/A23.2.

.3 Cooperate with and assist the independent testing agency and the Consultant during inspections and tests.

.4 Remove defective materials and completed work which fails tests and replace as directed by the Consultant.

.5 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control nor relieve the Contractor of its contractual responsibility.

.4 Test Panels

.1 Provide test panels 1.8 m x 1.2 m in size for the Consultant’s approval before starting the work of the following schedule:

.1 Plain concrete:

.2 Number 2 finish for slabs.

.2 Show on panels the specified finish including formwork tie holes and plugs.

.3 Erect panels individually or build-in on site in areas selected by the Consultant.

.4 Form as many panels as necessary until written approval has been issued by the Consultant.

.5 Upon approval, maintain sample panels in place throughout the duration of the Contract as the standard of workmanship to be adhered to.

.6 Upon completion of the concrete work, remove and dispose of the test panels off Site.

.5 Defective concrete:

.1 Concrete strength:

.1 Strength acceptance criteria from cylinder tests will be in accordance with CSA A23.1/A23.2.

.2 Concrete shall be considered defective when a cylinder test fails to meet the performance requirements for the corresponding concrete type, as defined in subsection 2.2 – Concrete Mixes, below.

.3 In such cases, the Consultant may require further action or testing in accordance with CSA A23.1, Clause 4.4.6.7 – Failure of Standard-Cured Cylinder Test Results to Meet Requirements.

.2 Concrete may be considered defective if it is structurally unsound, lacks moisture resistance, has surface defects, the measured air content fails to meet performance requirements or is improperly finished, as determined by the Consultant.

.3 The Consultant has the right to require replacement, strengthening or correction of impacted portions of defective concrete structure, in accordance with Clause 4.4.6.7.2 of CSA A23.1.

.4 The Contractor shall bear all costs of rectifying defective concrete including inspections, design, coring, testing, strengthening, demolishing, and replacement. The Contractor shall also bear investigation and evaluation costs even if further evaluation of the design allows the unit to be classified as acceptable concrete.

.6 Concrete delivery:

.1 There shall be a maximum time limit of 120 minutes from the time of initial mixing to complete discharge, in accordance with CSA A23.1 Clause 5.2.4.3.1 – Time of Delivery.

.7 Records:

.1 Before unloading at Site, have the concrete producer submit to the Consultant a delivery ticket (with each batch of concrete) on which is printed, stamped or written the following information:

.1 Name and location of batch plant.

.2 Date and serial number of ticket.

.3 Name of Contractor.

.4 Contract Name and Contract number.

.5 Concrete Mix Design Submission Form number, specified strength, target slump and air content at end of chute.

.6 Amount of concrete in cubic metres.

.7 Truck number, cumulative total, and/or load number.

.8 Time loaded or time of first mixing of cement and water/aggregate.

.2 Include the following information, which is to be registered by the producer's representative on at least two copies of the delivery ticket, after discharge has been completed:

.1 Time that load arrived on Site.

.2 Time that discharge of load was started.

.3 Time that discharge of load was completed.

.4 Type and amount of admixtures. If added at Site, initialed by the Consultant.

.3 Maintain accurate records of cast-in-place concrete elements. Include in the records the following information:

.1 Date of placing concrete element.

.2 Location of concrete element.

.3 Specified strength of concrete.

.4 Air and form temperature when concrete was placed

.5 Temperature of concrete when placed in the form

.6 Test samples taken and results of test samples.

.8 The Owner, in consultation with the Consultant, will appoint an independent inspection and testing company to verify compliance with this Specification in accordance with Section 01 45 00 – Testing and Inspection Services. Cooperate and coordinate with the inspector to facilitate inspection.

1.7 SUBMITTALS

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

.2 Certificates:

.1 Submit a current, valid “Certificate of Ready Mixed Concrete Production Facilities” as issued by the RMCAO for plants supplying concrete to the Contract.

.2 Submit certification from the concrete producer that a Professional Engineer licensed in the Province of Ontario has designed the mixes based on the requirements of the Specifications and that the concrete mixes will produce concrete meeting the performance requirements of the Specification Sections.

.3 Submit certification demonstrating that aggregates will not, nor have the potential to, react with cement to result in deleterious expansion in the concrete. Ensure these tests are current and represent the aggregates being supplied

.4 Submit certifications with the concrete mix design, that all concrete constituents are compatible.

.3 Quality Control Plan:

.1 Submit for review by the Consultant the Quality Control Plan which describes the material, equipment and procedures to be used for the following activities:

.1 Uniform and consistent concrete finishing.

.2 Cold weather protection when the air temperature is at or below 5 degrees Celsius.

.3 Hot weather protection when the ambient air temperature is at above 27 degrees Celsius.

.4 Concrete curing.

.5 Concrete placing.

.6 Temperature Management Plan including temperature monitoring and corrective measures.

.2 Submit concrete delivery records.

.4 Records

.1 Concrete pours: Maintain and submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken, as described in subsection 3.8 - Field Quality Control, below.

.2 Concrete hauling times: Maintain and submit records of deviations from the maximum allowable time of 120 minutes for concrete delivery.

.5 Shop Drawings:

.1 Master Plan(s) of Concrete Placements:

.1 Before submitting shop drawings of formwork, falsework and reinforcing bars, submit master plan(s) showing separate concrete placements and the locations of all expansion, isolation, control and construction joints, including any proposed construction joints that are in addition to those indicated on the Contract Drawings.

.2 Show layout and location for each type of joint, including expansion and construction joints.

.3 Show elevation or section taken through the plane of the joint showing the walls and slabs at the joint.

.4 Show details of joint fillers, sealant, adhesives, and other appurtenances.

.5 Show details of concrete inserts, including location, size, type and surface treatments.

.2 Concrete Placing Schedule:

.1 Submit concrete placing schedule.

.6 Concrete Mix Designs:

.1 Submit proposed performance mix design data, and the Supplier's applicable standard deviations.

.2 Tabulate concrete mixes. Indicate the types of cement, size of coarse aggregate, water/cementing material ratio, admixtures used, air content, slump, and the locations of use for each mix.

.3 For high slump flowing concrete submit a mix that will not result in segregation.

.7 Test Panels

.1 Provide test panels as specified in subsection 1.5 – Quality Assurance.

.8 Trial Mix Design Prequalification Test Results:

.1 Submit specified trial mix test results with the mix design as performed by an independent laboratory in accordance with CSA A23.1/A23.2.

.2 Identify the course of action to be taken if the testing program indicates that the requirements of the Contract Documents have not been met.

.3 Submit test data three weeks prior to concrete placement showing that the concrete supplied meets the performance criteria stated for each concrete types listed in subsection 2.2 – Concrete Mixes, below:

.1 At a minimum, the prequalification mix design test data shall prove that the minimum compressive strength, chloride ion content penetrability (for C-1 class

of exposure), density, shrinkage and air content of hardened concrete to be supplied meets or exceeds the performance criteria.

.2 Trial batching shall replicate the actual batching practices and placing procedures at the Site and the tests shall be based on the concrete samples taken from the point of discharge into the formwork.

.3 All prequalification testing of concrete and concrete constituents by the Contractor shall be done by a laboratory certified in accordance with CSA A283 for the appropriate category of testing.

.4 For standard mix (concrete mix that has been used before and is proposed to be used without any alterations of the mix design), historical test data that statistically demonstrates conformance to the Specification requirements may be submitted in lieu of mix design prequalification (trial batch testing), subject to review by the Consultant.

.9 Field Quality Control Test Results:

.1 Submit reports of results for each of the following field tests, and as described in subsection 3.8 – Field Quality Control, below:

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 Days.

.5 Air and concrete temperature.

.10 Product Data and Samples:

.1 Submit technical data and samples, where noted with quantities, of proposed materials including installation, application, and maintenance instructions for:

.1 Joint filler (100 mm length of each type).

.2 Curing compound.

.3 Evaporation retardant.

.4 Surface sealer.

.5 Floor hardener.

.6 Chemical hardener.

.7 Polyethylene sheet.

.11 Submit a Construction Waste Management plan as described in subsection 3.16 – Cleaning, below.

1.8 TRIAL MIXES

.1 Prior to the start of on-Site concrete construction, undertake trial mixes of each structural concrete mix design.

.2 Submit test results from trial mixes confirming workability and concrete strength.

.3 Undertake linear shrinkage testing of the trial mixes and submit test results.

.4 Adjust mixes that do not provide adequate performance, and re-test.

1.9 PRE-PLACEMENT MEETING

.1 Hold a meeting a minimum of 28 Days prior to the initial placement of concrete to review the detailed requirements for preparing the concrete design mixes, finishes, and procedures for concrete placement for the structures.

.2 Ensure key personnel, Site supervisor, Consultant, concrete formwork and finishing Subcontractors, concrete pumping and conveying equipment supplier, concrete producer and testing laboratories attend.

.3 Notify the Consultant a minimum of 10 Working Days prior to the scheduled date of the meeting.

.4 Provide an agenda for the meeting a minimum of 5 Working Days prior to the scheduled date of the meeting,

.5 Provide minutes of the meeting within 5 Working Days after the meeting. Circulate to all parties.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Comply with the manufacturers' recommendations for delivery, storage, and handling.

.2 Store materials in a manner that will prevent deterioration or contamination. Deteriorated or contaminated materials will be rejected and must be removed from the Site.

.3 Concrete:

.1 Deliver and store materials on Site in accordance with CSA A23.1/A23.2.

.2 Site-mixed concrete shall not be permitted.

.3 Concrete, mixed off-Site:

.1 When the truck mixer or agitator is accepted for mixing or delivery of concrete, do not add admixtures or water to batch after the initial introduction of mixing.

.2 If measured slump or entrained-air content falls outside specified limits, ensure another portion of the same sample is tested immediately. If second failure occurs, concrete will be considered to have failed the requirements of the Specification and will be rejected.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials.

1.11 SITE CONDITIONS

.1 Do not place concrete during or prior to rain.

.2 Prevent rain from reaching newly placed concrete in accordance with CSA A23.1/A23.2

.3 Cold weather protection:

.1 Maintain protection equipment, in a state of readiness, on Site. Use such equipment when the ambient temperature is at or below 5 degrees Celsius, or when, in the opinion of the Consultant the temperature may fall below 5 degrees Celsius before concrete has cured.

.2 Do not place concrete upon or against a surface that is at temperature lower than 5 degrees Celsius.

.3 Provide temperature-controlled enclosures for areas where concrete is placed whenever ambient air temperature is 5 degrees Celsius or lower.

.4 Protect concrete from the adverse effects of space-heated enclosures including local overheating and combustion products.

.5 Heat mix water and, if necessary, aggregates when air temperature is at or below, or predicted to go below, 5 degrees Celsius at any time during the next 24 hours.

.6 Maintain temperature of reinforcing bars and forms above 10 degrees Celsius prior to placing concrete.

.7 Maintain temperature of concrete when deposited in forms not less than 15 degrees Celsius but not higher than 25 degrees Celsius.

.8 Maintain temperature of concrete at surfaces at least 10 degrees Celsius for a minimum period of seven Days after placing and achieving minimum 75 percent of specified strength. Concrete temperature may then be lowered to ambient air temperature at a rate of 0.5 degrees Celsius per hour or 10 degrees Celsius per day.

.9 Use additional protection if full 28 Day compressive strength is required at an early age.

.10 Keep concrete continuously moist during the curing period.

.11 Obtain the Consultant's acceptance of the method of maintaining minimum temperatures.

.4 Hot weather protection:

.1 Maintain protection equipment in a state of readiness on Site. Use such equipment when the ambient temperature is at or above 27 degrees Celsius, or when, in the opinion of the Consultant the temperature may exceed 27 degrees Celsius before concrete has cured.

.2 When ambient temperature is at or above 27 degrees Celsius, protect concrete from direct sunlight and keep forms moist by sprinkling with cool water, applying wet burlap, or other accepted methods of cooling that will not adversely affect the concrete.

.3 Do not place concrete when the concrete temperature exceeds 27 degrees Celsius in the mixer.

.4 Concrete, which has a temperature in the mixer between 20 degrees Celsius.and 27 degrees Celsius shall:

.1 Contain a retarder which reduces mixing water requirements and increases strength.

.2 Not contain high early strength cement.

.5 Protect forms and equipment, including both mixing and placing equipment, from the rays of the sun and cool by wetting as necessary to maintain a temperature of not more than 5 degrees Celsius in excess of the ambient temperature nor more than 30 degrees Celsius.

.6 Prior to placing concrete, wet down forms and reinforcement and the area surrounding the work. Ensure that excess water is swept and drained away immediately before casting the concrete.

.7 Keep mixing time to the minimum, consistent with the production of the quality of concrete specified and place mixed concrete immediately.

.8 Use sufficient qualified personnel for rapid placing and finishing of concrete.

.9 Commence continuous wet curing as soon as the concrete has hardened sufficiently to prevent surface damage.

.5 Protection from drying:

.1 When the rate of surface moisture evaporation exceeds 0.50 kg/m2/h, take additional measures to prevent rapid loss of moisture from surface of concrete as accepted by the Consultant and in accordance with CSA A23.1 Clause 7.4.1.2 – Severe Drying Conditions.

.6 Frost Protection for Footings and Slabs on Grade:

.1 Protect subgrades below proposed concrete work. Ensure that subgrade temperatures are a minimum of 10 degrees Celsius when the concrete is placed.

.2 Provide continuous protection for footings and slabs on grade to prevent the sub-grade below from freezing during cold weather. Provide heated enclosures and insulation as required.

.7 Influence of Ambient Concrete Temperature on Concrete Crack Control:

.1 To minimize the formation of thermal cracks during placement and curing, maintain previously cured concrete and concrete that will be placed against it at the same temperature.

.2 Failure to minimize temperature differential between adjacent pours may result in temperature induced cracking. Repair such cracks as specified in this Section.

.8 Backfilling and Service Loads Restrictions:

.1 Obtain approval from the Consultant prior to backfilling around structures.

.2 Verify that the backfill is not higher than the finished grades indicated in the Contract Documents.

.3 Verify that equipment for backfilling and compaction on top of slabs will not impose loads greater than those indicated in the Contract Documents.

.4 Verify that concrete in walls, and slabs, struts, and cross walls, which frame into the walls providing lateral stability, has been placed and has attained the specified compressive strength before backfilling against walls or subjecting walls to service loads.

.5 Verify that concrete in slabs, including slabs on grade supported by piles or caissons, and support components, have reached the specified compressive strengths before backfilling or subjecting slabs to service loads.

2 Products

2.1 MATERIALS

.1 General:

.1 Use admixtures for concrete conforming to CSA A23.1/A23.2, unless otherwise acceptable to the Consultant.

.2 Have the concrete producer certify that admixtures are compatible.

.3 Use Products in accordance with the manufacturer's printed instructions unless otherwise acceptable to the Consultant.

.4 Fresh concrete to be normal density concrete (2350 kg/m^3 ± 100 kg/m^3), unless otherwise noted in Part 2.2 – Concrete Mixes.

.2 Cement and supplementary cementing materials: in accordance with CSA A3001:

.1 For use in general concrete construction, when the special properties of other cement types are not required, Portland cement Type GU or blended hydraulic cement type GUb shall be used.

.2 Should the Contractor choose to include silica fume cement in the concrete mix design, the substitution of silica fume shall not exceed 8% by mass of Portland cement.

.3 Should the Contractor choose to include fly ash in the concrete mix design, the substitution of fly ash shall not exceed 25% by mass of Portland cement.

.4 Should the Contractor choose to include a Ground Granulated Blast Furnace Slag (GGBFS) in the concrete mix design, the substitution of GGBFS shall not exceed 50% by mass of Portland cement, unless specifically accepted by the Consultant.

.3 Aggregates:

.1 Course aggregates: In accordance with CSA A23.1/A23.2. All aggregate sources as listed on the MTO’s designated Source Materials (DSM) list.

.2 Fine aggregates: In accordance with CSA A23.1/A23.2.

.4 Water: in accordance with CSA A23.1/A23.2.

.5 Admixtures:

.1 Air entraining admixture: in accordance with CSA A23.1/A23.2 and ASTM C260/C260M.

.2 Chemical admixture: in accordance with CSA A23.1/A23.2, ASTM C260 and ASTM C494. The Consultant is to approve accelerating or set retarding admixtures during cold and hot weather placing.

.1 Water-reducing admixture: ASTM C494/C494M, Type A.

.2 Retarding admixture: ASTM C494/C494M, Type B.

.3 Accelerating admixture: ASTM C494/C494M, Type C.

.4 Water-reducing and retarding admixtures: Type D.

.5 Water-reducing and accelerating admixture: Type E.

.6 Water-reducing high range admixture (super plasticizers): Type F.

.7 Water-reducing, high range and retarding admixtures (super plasticizers): Type G.

.8 Specific performance admixtures: Type S.

.6 Curing compound: to CSA A23.1/A23.2 white.

.7 Non-shrink grout: Shrinkage compensating grout, pre-mixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.1 Compressive strength: 40 MPa at 28 Days.

.8 Non premixed dry pack grout: composition of non-metallic aggregate 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 28 Days.

.9 Dry Pack Material: One part cement and three parts sand (fine aggregate) by volume. Add water to obtain a consistency that when a sample is squeezed, only enough water will come to the surface to moisten hand. Maximum water content shall be 4.5 L to 23 kg of cement.

.10 Dovetail anchors and slots: Minimum 0.64 mm thickness, Z275 zinc coated galvanized steel with fillers to prevent entry of concrete during pouring and minimum 2 mm overall thickness.

.11 Rigid insulation: In accordance with CAN/ULC S701 Type 4, extruded polystyrene:

.1 Low Density Insulation:

.1 Styrofoam brand, SM Extruded Polystyrene Foam Insulation by Dow Chemical Canada ULC.

.2 Foamular C-300 Extruded Polystyrene Rigid Insulation by Owens Corning Canada.

.2 High Density Insulation:

.1 Styrofoam brand, Highload 40 (Hi-40) Extruded Polystyrene Insulation by Dow Chemical Canada ULC.

.2 Foamular 600 High Density Extruded Polystyrene Rigid Insulation by Owens Corning Canada.

.12 Drilled Anchors:

.1 HIT-HY 200 System by Hilti (Canada) Corporation.

.2 HSL-3 Heavy Duty Expansion Anchor by Hilti (Canada) Corporation.

.13 Bond breakers: 810-07 Non-Fibered Asphalt Roof and Foundation Coating by Henry Company Canada Inc.

.14 Premoulded joint fillers:

.1 Bituminous impregnated fibre board: in accordance with ASTM D1751.

.2 Sponge rubber: in accordance with ASTM D1752, Type I, flexible firm grade.

.3 Self-expanding Standard cork: in accordance with ASTM D1752, Type III.

.15 Surface hardener:

.1 Factory premixed natural emery aggregates with Type GU normal Portland cement, superplasticizers and wetting agents:

.1 EmeriCrete SH by Sika Canada Inc.

.2 CPD Floor Hardener Pre-mix (Premium) by CPD Construction Products.

.3 MBT brand, Mastercron Ff by BASF – Building Systems.

.16 Sump Pit Waterproofing:

.1 Primer and Moisture Control: Penetrating two-component primer and moisture control system, standard colour, 3 mm to 4 mm dry film overall system thickness.

.2 Coating: Chemical resistant, semi-gloss finish, standard colour, 2.5 mm dry film overall system thickness; single application.

.3 Filler and Grout: Compatible with coating and as recommended by the coating manufacturer.

.4 Joint Backing: Preformed, compressible strips of closed cell polyethylene or urethane foam, rubber tubing or non-migrating plasticized vinyl, oversized 25%, compatible with sealant, primer, epoxy surfacing and substrate.

.5 Joint Sealant: CAN/CGSB-19.24-M, Type 1, Class B, multi-component modified urethane base chemical curing; material compatible with the coating and as recommended by the coating manufacture.

2.2 CONCRETE MIXES

.1 Performance Requirements:

.1 Proportion concrete for structures to create high performance concrete with improved durability, reduced shrinkage and reduced cracking.

.2 Density: Normal density.

.3 Linear Shrinkage:

.1 Limit linear shrinkage to 0.040% after 28 Days drying for 40 mm aggregate concrete and 0.045% after 28 Days drying for 20 mm aggregate concrete.

.4 Durability Design Life

.1 Provide concrete produced under this Section with an expected design life of at least 70 years for the service conditions defined by the usage, and the exposures specified in the Contract Documents.

.2 General:

.1 Establish proportions of cementing materials, aggregates, water, and admixtures required to produce consistent workable concrete with strength and other properties specified, in accordance with CSA A23.1/A23.2.

.2 Design concrete so that material will not segregate and excessive bleeding will not occur.

.3 Use same types and brand of cement throughout.

.4 Comply with and allow for the supplier's Standard Deviation as specified in CSA A23.1/A23.2, Clause 4.4.6.7 Compressive Strength Requirements.

.5 Admixtures plant added with the mix water.

.3 Unshrinkable fill: Ontario Provincial Standard Specification OPSS 1359.

.4 Mixes for Normal Density concrete (Unless otherwise noted on the drawings):

.1 High performance concrete for foundations, footings and foundation walls:

.1 Class F-1 exposure.

.2 30 MPa at 28 Days.

.3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm unless the slab is less than or equal to 400 mm thickness.

.2 Concrete grout for starting structural walls below-grade at construction joint:

.1 Class F-1 exposure.

.2 30 MPa at 28 Days.

.3 Utilize mix 1 above without the coarse aggregate.

.3 High performance concrete for interior slabs, including slabs-on-grade and slabs-on-deck:

.1 Class N exposure.

.2 32 MPa at 28 Days.

.4 Exterior reinforced concrete slabs:

.1 Class C-1 exposure.

.2 35 MPa at 28 Days.

.3 Air content category 1.

.4 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.

.5 Exterior unreinforced concrete slabs, pavements, sidewalks and curbs:

.1 Class C-2 exposure.

.2 32 MPa at 28 Days.

.3 Maximum aggregate size 40mm for slab greater than 400mm thickness and 20mm for slabs less than or equal to 400 mm thickness.

.6 Lean fill, pipe bedding, duct banks, encasements, underpinning and skim slabs:

.1 Class N exposure.

.2 15 MPa at 28 Days.

.3 Maximum aggregate size 20mm.

.5 Mix for Pumped Concrete:

.1 Comply with the requirements of ACI 304.2R and this Section.

.2 Use coarse and fine aggregate with a uniform grading curve.

.3 Superplasticizing admixture may be used for pumped concrete.

.4 Do not use admixtures which promote bleeding.

3 Execution

3.1 RELEASES

.1 Obtain the Consultant's release:

.1 For reinforcement, formwork, falsework, and inserts as placed.

.2 To commence placing concrete.

.2 Provide the Consultant with written notice of the Contractor's intent to pour between 24 hours and 7 Days prior to the pour.

.3 Provide a completed Concrete Pour Release Form (attached as a supplement to this Section) prior to each pour and allow the Consultant 2 hours for their review.

.4 Do not order concrete until the Concrete Pour Release Form has been signed by the Consultant.

3.2 PREPARATION

.1 Obtain written approval from the Consultant before placing concrete. Provide 24 hours minimum notice prior to the placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 – Concrete Reinforcing.

.3 Remove water, snow, ice, loose soil, laitance, curing compound, wood, and other debris from surfaces on or against which new concrete will be placed.

.4 Roughen and clean surfaces of previously placed concrete against which subsequent concrete will be placed.

.5 During concreting operations:

.1 The development of cold joints shall not be allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum re-handling, and without damage to the existing structure or Work.

.6 Pumping of concrete is permitted only after the approval of equipment and mix.

.7 Ensure reinforcement and inserts are not disturbed during concrete placement.

.8 Prior to placing of concrete, obtain the Consultant's approval of the proposed method for protection of concrete during placing and curing.

.9 Protect the previous Work from staining.

.10 Clean and remove stains prior to application for concrete finishes.

.11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

.1 Place steel dowels of deformed steel reinforcing bars and pack solidly with non-shrink grout to anchor and hold dowels in positions as indicated in the design drawings.

.13 Do not place load upon new concrete until authorized by the Consultant.

3.3 MAXIMUM SIZE OF CONCRETE PLACEMENTS

.1 Limit the size of each placement to allow for strength gain and volume change due to shrinkage.

.2 Add construction joints as necessary to suit pour sizes. Confirm the joint location with the Consultant and adjust as necessary.

.3 Consider beams, girders, brackets, column capitals, and haunches as part of the floor or roof system above and place monolithically with the floor or roof system.

.4 Construction Joints in Unrestrained Slabs on Ground:

.1 Base Slabs placed on the ground may be placed continuously from outside edge to outside edge, outside edge to expansion joint, or from expansion joint to expansion joint, unless shown otherwise on the Drawings.

.5 Construction Joints in Suspended Slabs Restrained by Connecting Walls:

.1 Place slab in alternate strips with the larger dimension of any single placement no greater than 15,000 mm for slabs.

.2 Locate construction joints in suspended slabs near the middle quarter of the spans of slabs and beams, unless indicated otherwise on the Contract Drawings. If a beam intersects a girder at this location, offset the construction joint in the slab and girder by a distance equal to two times the depth of the beam.

.6 Construction Joints in Girders and Beams:

.1 Construct concrete beams and suspended slabs monolithically, unless indicated otherwise on the Contract Drawings.

.2 If vertical construction joints are required, provide shear key, and additional inclined shear reinforcing steel. The Consultant's review and acceptance is required for any joints added into girders and beams.

.7 Construction Joints in Walls:

.1 Limit pours to a maximum of 6.5 m vertically.

.2 Allow 3 Days between adjacent pours.

.3 Locate construction joints a minimum of 2,000 mm away from any junction of two or more walls, a column or beam supported on a wall, the nearest edge of an opening wider than 600 mm, and a construction joint in a slab on which the wall rests.

.4 Place wall in alternate portions with a distance between vertical construction joints not exceeding 15,000 mm for walls

3.4 INSTALLATION/APPLICATION

.1 Prevent damage to waterproofing where concrete is poured against waterproofing.

.2 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, slab drop panels, column capitals or columns, except where indicated or approved by Consultant.

.2 Where approved by Consultant, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere in the Contract Documents.

.3 Sleeves and openings greater than 100 x 100 mm not indicated in design drawings must be reviewed by the Consultant.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from the Consultant before the placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on the Drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.3 Anchor rods:

.1 Prior to placing concrete, place anchor bolts in locations indicated on the reviewed shop drawings under the supervision of the trade supplying anchor bolts and templates in accordance with the manufacturer's printed instructions and in accordance with CSA A23.1/A23.2.

.4 Grout under base plates:

.1 Grout under base plates using procedures in accordance with the manufacturer's recommendations that result in 100% contact over grouted area. Thoroughly compact leaving no voids.

.5 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Consultant.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form isolation, construction and expansion joints as indicated on the Drawings and as described in this Section.

.6 Horizontal Construction Joints in Reinforced Concrete Walls and Columns:

.1 Thoroughly clean and saturate the surface of the joint with water.

.2 For walls and columns, place grout onto the existing concrete before starting regular concrete placement. Limit wall and column grout placement to a maximum thickness of 50 mm and a minimum thickness of 30 mm.

.7 Dovetail anchor slots:

.1 Install continuous vertical anchor slots to forms where masonry abuts concrete wall or columns.

.2 Install continuous vertical anchor slots at 800 mm o.c. where concrete walls are masonry faced. Anchors shall project to within 20 mm minimum of masonry face.

.3 Do not install anchor slots in underground concrete walls cast against excavation support systems

3.5 PROTECTION AND CURING

.1 Protect and cure concrete in accordance with CSA A23.1, Clause 7.4 and Table 20.

.2 Protect freshly placed and finished concrete from adverse conditions such as premature drying, moisture loss, defacement due to building operations, and from excessive hot and cold temperatures, for the period of time corresponding to the required curing type of concrete.

.3 Commence protection immediately after placing to achieve the temperature and moisture conditions for the period of time necessary for the concrete to develop its required properties.

.4 Concrete elements shall be protected to limit the temperature differential between the concrete core and the concrete surface within 20°C.

.5 Protection shall not be removed until the concrete has cooled to the temperature differential given in the CSA A23.1, Table 21, in order to avoid cracking of the concrete due to the sudden temperature change near the end of the curing period.

.6 Removal of forms prior to the minimum curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum time periods specified for curing and protection. Refer to CSA A23.1, Clause 7.4.1.5.3.4.

.7 Curing types based on CSA A23.1, Table 20, as modified in this Section:

.1 Type 1 – Basic curing: Three days at ≥10°C or for the time necessary to attain 40% of the specified strength.

.2 Type 2 - Additional curing: Seven days total at ≥10°C and for the time necessary to attain 70% of the specified strength.

.3 Type 3 - Wet curing: Seven days at ≥10°C and for the time necessary to attain 70% of the specified strength.

.4 Note: Silica fume concrete must be wet cured.

.8 Wet Curing of Concrete:

.1 When wet curing is required, start fog misting immediately after placing operations are completed, in order to prevent plastic shrinkage and cracking from taking place.

.1 Fog misting must be applied continuously from the time of screeding until concrete is covered with burlap or other moisture-retaining covering, in such a way as to maintain high relative humidity above the concrete and prevent drying of the concrete surface.

.2 When concrete has set, cover horizontal surfaces with at least one layer of wet burlap or other moisture-retaining covering.

.1 Strips must overlap 150 mm and must be held in place without marring the surface of the concrete.

.2 Provide suitable weights to prevent blow-off or displacement of protective cover.

.3 Burlap must be pre-soaked by immersing it in water for a minimum period of 24 hours prior to placing and must be maintained in a continuously wet condition throughout the curing period by means of a soaker hose.

.4 Do not permit intermittent drying.

.5 Remove burlap after a minimum of 7 consecutive Days and allow to air dry until the concrete has developed the specified design strengths.

.3 Water must not be allowed to drip, flow or puddle on the concrete surface during fog misting, when placing the burlap or at any time before the concrete has achieved final set.

.9 Use of Curing Compounds and Evaporation Reducers:

.1 Except where concrete wet curing is required, the use of pigmented curing compounds and evaporation reducers may be authorized by the Consultant.

.2 Apply curing compound/evaporation reducer after placing or finishing operations have been completed, in accordance with the compound manufacturer's printed instructions.

.3 Ensure the compound application is uniform and continuous over entire area being cured.

.4 Where surfaces are to be exposed to sunlight, use compound with white pigment.

.5 Do not use curing compounds on surfaces where a bond is required for additional concrete or where a bonded surface coating such as paint, tile, resilient flooring, and similar materials are to be applied.

.10 Curing Plan:

.1 Detailed curing plan containing (at minimum) the duration of curing, the manner in which the surface will be kept moist, type of curing material, and provisions to address potential problems (for example, high winds or extreme weather conditions) shall be prepared by the Contractor and submitted for review by the Consultant as part of the Work plan requested in subsection 1.6, above.

3.6 FINISHING

.1 Treat and finish exposed formed surfaces in accordance with CSA A23.1.

.2 Grout tie holes in concrete flush to the concrete surface. Grout with finishing cement mortar using the same sand and cement as used in the concrete.

.3 Pack grout into place to fill the tie hole and finish to match the adjacent concrete surface.

.4 After the removal of forms, strike off projections, and fill honeycombing and defects in accordance with CSA A23.1/A23.2.

.5 Refer to honeycombed areas for inspection and designation as structural or non-structural and repair as directed by the Consultant.

.6 Floor finish classification: Class A in accordance with Table 22 of CSA A23.1.

.7 Except where indicated otherwise in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents, follow the follow finishing schedule:

AREA	**Type of Finish**
Wall Surfaces – Exterior:	
1. Above grade/exposed (above a point 150 mm below finish grade)	Number 6 Finish
2. Above grade/covered with brick veneer or other finish material	Number 5 Finish
3. Backfilled (below a point 150 mm below finish grade)	Number 4 Finish
Slabs – Upper Surface:	
4. Firing Range floor slab and Shipping & Receiving floor slab	Number 2 Finish
5. Exterior roof slab/covered with roofing or waterproofing material	Number 1 Finish
6. Other exterior slabs	Number 2 Finish
7. Stairs and landings	Number 3 Finish
8. Top of interior buildings slabs	Number 2 Finish
9. Top of interior slabs to receive mortar setting bed for tile	Number 7 Finish
10. Top of interior slabs to receive resilient flooring or carpet, chemical resistant coating, special flooring, tiles on thin set mortar	Number 2 Finish
11. Equipment bases	Number 2 Finish
12. Where shake on hardener is applied	Number 2 Finish

.8 Finish type other than those indicated in the Room Finish Schedule on the Contract Drawings or elsewhere in the Contract Documents shall be as follows:

.1 Number 1 Finish (Wood Float):

.1 After screeding by accepted method to obtain required floor tolerances, work the surface by means of a wood float in such a manner that after concrete has hardened, no portion of surface shows a variation of more than that specified.

.2 Number 2 Finish (Trowelled):

.1 After screeding and compaction with a wooden float, bring the surface to a smooth level and dense finish free from trowel marks, ridges and depressions by means of steel trowels operated either by hand or by mechanical means.

.2 Do not sprinkle dry cement or sand on the surface during the trowelling process.

.3 Maintain ambient temperature at a minimum of 10°C, when steel trowelling is in progress.

.3 Number 3 Finish (Broomed):

.1 Before the floated surface has fully hardened, brush the surface with a stiff broom in one direction to leave a rough surface.

.4 Number 4 Finish (Formed):

.1 As soon as forms have been removed and directions given by the Consultant, remove projections and fill honeycombing and defects.

.5 Number 5 Finish (Smooth Formed):

.1 As soon as forms have been removed and directions given by the Consultant, patch formwork tie holes, grind off projections, irregularities and rough spots, patch surface defective areas and repair rough spots. Provide a smooth uniform appearance

.6 Number 6 Finish (Rubbed):

.1 As soon as forms have been removed and holes pointed, rub surface with an abrasive rubbing brick until form marks and blemishes are removed and the surface is smooth and of uniform texture and colour.

.2 Do not remove from a larger surface than can be rubbed to fine finish within 6 hours.

.7 Number 7 Finish (Floor to Receive Bonded Topping, Screed, Grout, or Porcelain Tile):

.1 Strike off and screed the concrete base slab to a level below the final floor surface equal to the specified thickness of the finish course as shown on the Drawings.

.2 Float the surface.

.3 Wire broom the surface to make 6 mm deep grooves at approximately 20 mm centres, running in one direction.

.9 Where the schedule of finishes requires painting, prepare surfaces for painting as specified in Section 09 91 00 - Painting.

.10 Surface Hardener:

.1 In area(s) indicated to receive surface hardener, power screed the floor slab and float.

.2 Over freshly floated concrete apply surface hardener in accordance with the manufacturer's printed instructions.

.3 Distribute evenly, do not throw hardener.

.4 Float between applications of hardener and after second hardener application with power floats.

.5 Machine trowel to smooth, level, and dense surface of uniform colour, free from trowel marks, ridges, pinholes, and other defects.

.6 Have the manufacturer's representative on Site within 24 hours when requested by the Consultant.

.11 Ensure that the concrete finish is compatible with specified traffic topping or other applied finish.

.12 Production of smooth surfaces by means of cement plaster is not permitted

3.7 CONSTRUCTION TOLERANCE

.1 Concrete tolerances shall be in accordance with CSA A23.1/A23.2 clause 6.4 - Construction Tolerances for Cast-in-Place Concrete, and subsection 1.5 – Quality Assurance, above.

3.8 FIELD QUALITY CONTROL

.1 Site tests: Conduct tests as follows in accordance with CSA A23.1/A23 and submit results as described in subsection 1.6 – Submittals, above.

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 Days.

.5 Chloride ion content penetrability (for exposure class C-1 concrete).

.6 Air and concrete temperature.

.2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Consultant for review in accordance with CSA A23.1/A23.2.

.1 Ensure testing laboratory is certified in accordance with CSA A283.

.3 Ensure test results are distributed for discussion at the pre-pouring concrete meeting between the testing laboratory and Consultant.

.4 The Consultant will take additional test cylinders during cold weather concreting. Cure cylinders on Site under the same conditions as concrete which they represent.

.5 Non-Destructive Methods for Testing Concrete: in accordance with CSA A23.1/A23.2.

.6 Inspection or testing by the Consultant will not augment or replace the Contractor's quality control requirements nor relieve Contractor of any of its responsibilities under the Contract.

3.9 LOADING OF STRUCTURE

.1 Do not load any portion of structure prior to achieving 70% of specified strength and only with the acceptance of the Consultant.

.2 Removal of forms prior to the minimum required curing period does not remove the Contractor's obligation to cure and protect the exposed concrete for the minimum required time periods specified. Refer to subsection 3.5 of this Section above.

3.10 REPAIRING SURFACE CRACKS IN CONCRETE

.1 After concrete has set for a minimum of 28 Days, and before a maximum of 125 Days, examine surfaces carefully for cracks.

.2 Rout cracks larger than 0.3 mm at the discretion of the Consultant.

.3 Fill cracks with non-shrink grout.

.4 Match the surface to existing surfaces in quality, texture, colour, and elevation.

3.11 REPAIR OF TEMPERATURE AND SHRINKAGE INDUCED CRACKS

.1 Repair cracks in the completed structures employing a suitable polyurethane injection technique to make such cracks completely watertight after repair.

.2 Remove surface injection materials following the completion of the Work and finish the affected areas to match the surrounding concrete.

3.12 INJECTION OF CRACKS – POLYURETHANE GROUT

.1 Use materials in accordance with the manufacturer's printed instructions.

.2 Clean and prepare cracked areas in accordance with the manufacturer's recommendations.

.3 Inject polyurethane grout into cracks in accordance with the manufacturer's written instructions.

.4 Commence injection at the lowest injector on a vertical face and at one end on a horizontal surface. Continue injection until pure uncontaminated material flows out from adjacent injectors. Cap the injectors and proceed to adjacent injectors until all injectors have been filled.

.5 Upon completion, remove injectors and surface sealer. Thoroughly clean the concrete surfaces of excess grout material. Finish the surface to match the surrounding concrete.

.6 Patch injection holes.

3.13 PATCHING

.1 Carry out patching as specified in CSA A23.1/A23.2.

.2 Make good temporary openings left in concrete for pipes, conduits, ducts, shoring, and other Work during construction.

.3 Reinforce with welded wire fabric, as required, and finish to match the surrounding work.

3.14 SEALANT APPLICATION

.1 Do not fill joints sooner than 30 Days after concrete pours.

.2 Comply with the manufacturer's printed instructions and curing and sawcutting requirements.

.3 Execute joint sealing during cool, dry ambient conditions when the slab is in a contracted state to minimize future joint separation at sealant filled joints.

.4 Fill sawn joints in concrete slabs full depth with sawcut joint sealant.

.5 Seal over pre-moulded joint filler with joint sealant.

.6 Comply with the sealant manufacturer's primer, application, and temperature requirements. Mask floor to edge of joints and fill joint with sealant.

.7 After initial set, prime sealant surface and refill joints with sealant as required to produce a slightly convex joint surface.

3.15 CLEANING

.1 Cleaning:

.1 Promptly as the Work proceeds and upon completion, clean-up and remove from the site, the rubbish and surplus material resulting from the Work of this Section.

.2 Leave the Work area clean at the end of each Day.

.3 Final Cleaning: upon completion, remove surplus materials, rubbish, tools and equipment.

.2 Waste Management:

.1 Prepare a Construction Waste Management plan in accordance with Section 01 74 19 - Construction Demolition &Waste Management Plan.

.2 Separate waste materials for reuse and recycling.

.3 Divert unused concrete materials from landfill to local quarry or facility after receipt of written approval from Consultant.

.4 Provide an appropriate area on Site where concrete trucks can be safely washed.

.5 Divert unused admixtures and additive materials (pigments, fibres) from landfill to an official hazardous material collections site as approved by Consultant.

.6 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.7 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.8 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.9 Dispose of waste in accordance with applicable local, provincial and national regulations.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Supply and install all miscellaneous metal work indicated on drawings and not included in the work of other Sections in addition to items listed in this Section.

1.3 RELATED REQUIREMENTS

.1 Read carefully all other Sections and review drawings to determine extent of metal work supplied and installed, or installed by others.

.2 Be responsible for co-ordinating this section with all related sections.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless

.2 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

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

.4 ASTM C939, Standard Test Method for Flow of Grout for Preplaced Aggregate Concrete (Flow Cone Method)

.5 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with improved Formability, and Ultra-High Strength

.6 ASTM C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

.3 Canadian Standards Association (CSA):

.1 CSA G40.20-04/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

.2 CAN/CSA-G164-M92, Hot Dip Galvanizing or Irregularly Shaped Articles

.3 CSA-S16, Design of Steel Structures

.4 CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members

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

.6 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum

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

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating

.2 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type

.3 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base

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

.1 SSPC-SP 1, Solvent Cleaning

.2 SSPC-SP 2, Hand Tool Cleaning

.3 SSPC-SP 3, Power Tool Cleaning

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

1.5 QUALITY ASSURANCE

.1 All Codes and Standards referred to in this Specification shall be current editions including all latest revisions and addenda.

.2 Conform to requirements of CSA-S16, Design of Steel Structures and CAN/CSA-S136, Cold Formed Steel Structural Members.

.3 Architectural metals work shall be of the highest architectural quality, free of scratches, pitting, roughness, marring, discolouration, staining and other imperfections.

.4 Work of this Section to be executed by firm thoroughly conversant with laws, by-laws and regulations which govern, and capable of workmanship of best grade of modern shop and field practice known to recognized manufacturer's specializing in this work.

.5 Work of this Section shall be executed by workers especially trained and experienced in this type of work. Have a full time, senior, qualified representative at the site to direct the work of this Section.

.6 Where required by authorities having jurisdiction, have work of this Section designed by a professional engineer licensed to design structures and registered in the Province of the Work.

1.6 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures, bearing stamp or seal and signature of the Professional Engineer responsible for the design of the work of this Section.

.2 Shop Drawings:

.1 Make thorough examination of drawings and details, determine the intent, extent, and materials, and be fully cognizant of requirements when preparing shop drawings.

.2 Submit shop drawings showing and describing in detail all work of this Section including large scale detail of members and materials, of connection and interfacing with work of other Sections, jointing details, and of anchorage devices, dimension, gauges, thicknesses, description of materials, metal finishing, as well as other pertinent data and information.

.3 Digital files of design drawings shall not be used in the preparation of shop drawings.

1.7 STORAGE, DELIVERY, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off the ground, under cover storage locations. Do not load any area beyond the design limits.

.2 Adequately protect and crate all components against damage, dirt, disfigurement and weather during delivery and storage. Damaged materials shall not be used and shall be replaced by approved material.

.3 Cover and protect the work of other Sections in the area of work from damage. Make good all damage to the satisfaction of the Consultant.

.4 Protect the installed work of this Section and on completion the work shall be examined and damage shall be remedied to the complete satisfaction of the Consultant.

2.1 MATERIALS

.1 Structural Steel Sections and Steel Plate: New stock (not weathered or rusted); to conform to CAN/CSA-G40.21, Grade 300W (44W) and Grade 350W (50W) for wide flange shapes.

.2 Hollow Structural Sections (HSS): New stock; to conform to CAN/CSA-G40.21, Grade 350W (50W), Class C, stress relieved.

.3 Sheet Steel (Structural Quality): Conforms to ASTM A1011/A1011M.

.4 Sheet Steel (Commercial Quality): Conforms to ASTM A653/A653M, stretcher levelled or temper rolled.

.5 Tube: Conforms to ASTM A53.

.6 Galvanized Sheet Steel (Commercial Quality): Galvanized coating G90 (Z275) in accordance with ASTM A653/A653M, minimized spangle, stretch levelled or temper rolled. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.7 Steel Pipe: Hot-dip galvanized, zinc coated, welded and seamless type steel pipe conforming to ASTM A53/A53M.

.8 Non-Shrink Grout: Premixed, high strength, maximum bearing, impact resistant, non-shrink non-metallic aggregate grout having minimum 55 MPa 28 day compressive strength and conforms to ASTM C939 and ASTM C1107/C1107M, MasterFlow 816 by Master Builders Solutions, or Sika Grout 212 HP by Sika Canada Inc.

.9 Galvanizing: All uncoated steel specified to be galvanized shall be galvanized after fabrication by the hot dip process according to CAN/CSA-G164, with minimum coating of 600 g/m^2 (2 oz./sq.ft.) Galvanize after all welding is complete. Welding of galvanized material will not be permitted. Specially treat by phosphate conversion process conforming to CGSB 31-GP-105Ma ready to receive prime paint finish.

.10 Primer Paint: CISC/CPMA 2-75.

.11 Bolts, Nuts, Washers: Conforms to ASTM A325.

.12 Welding Materials: Conforms to CSA W59.

.13 Metal Filler: Polyester based type.

.14 Zinc Rich Paint For Touch-up of Galvanized Metals: Ready mixed, zinc-rich primer conforming to CAN/CGSB-1.181, Zinc Clad No. 5 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd., or approved equal.

.15 Refer to Section 09 90 00 – Painting for site finish paint requirement.

.16 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.17 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.18 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

2.2 FABRICATION

.1 Fit and assemble work in shop where possible. Execute work according to details and reviewed shop drawings.

.2 Take measurements at the building for work which is to fit or be connected to steel or concrete before commencing fabrication.

.3 Where shop fabrication is not possible, make trial assembly in shop.

.4 Do all welding in accordance with requirements of CSA W59, CSA W55.3 and CSA W47.1 including all supplements. Weld stainless steel electric arc process. Grind welds smooth and flush with surface of parent metal, where exposed to view and where specifically indicated on

drawings. Welds shall be continuous seam welds unless specified otherwise. Maintain sharp arises.

.5 Fit joints and intersecting members accurately in true planes, square, plumb, straight with tight joints and intersections.

.6 Provide adequate reinforcing, fastenings, anchors, accessories required for fabrication and erection of work of this Section. Such items occurring on or in an exterior wall or slab shall be hot-dip galvanized. Make thread dimensions such that nuts and bolts will fit without rethreading or chasing threads.

.7 Fabricate, drill and tap members to accommodate attachments, anchorage and work of other Sections where located and directed by them.

.8 Exposed steel surfaces shall be smooth and free from imperfections such as warping, buckling, weld marks, burrs, rust and scale.

.9 Gauges and sizes of metal shall be adequate for various conditions.

.10 Make exposed metal fastenings and accessories of same material, texture, colour and finish as base metal on which they occur unless otherwise shown or specified. Keep exposed fastenings to an absolute minimum evenly spaced and neatly laid out. Make fastenings of permanent type unless otherwise indicated.

2.3 SHOP PAINTING AND PROTECTION

.1 As per SSPC2 Hand Tool Clean and SSPC1 Solvent Clean, clean welds by wire brushing and wash down with clean water, to remove the chemical residues left by the electrodes, prior to painting.

.2 Prepare steel as per SSPC-3 Power Tool Cleaning for Interior or SSPC-6 Commercial Blast Cleaning for exterior members. Remove rust, mill scale, oil, dirt, and other foreign matter before commencing shop painting.

.3 Apply shop coat of primer to all surfaces except areas requiring field welding. Apply by brush, working paint well into surfaces, interstices and cavities.

.4 Primer is to be free of runs, sags, or other collections of primer due to dipping of members into primer.

.5 Steel work shall be painted under cover, and shall remain under cover, until the paint protection is dry.

.6 Prime field welded areas after erection and touch up shop coat where damaged and barred by erection and handling.

.7 Prime steel with two full coats of paint in strict accordance with paint manufacturer's directions.

.8 Give the parts which are inaccessible after assembly two coats of primer coat paint, of different colours, when members are noted to be painted.

2.4 HOT DIP GALVANIZING

.1 Hot dip galvanize, after fabrication, steel metal fabrication items. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with brush or spray-applied anti-corrosion coating containing 92-95% zinc, in accordance with manufacturer's printed directions.

.1 Members exposed to elements when in final location.

.2 Members embedded on exterior side of exterior walls.

.3 Members imbedded in concrete.

.4 Members specified in this Section or indicated on Drawings.

.2 Hot-dip galvanize members in accordance with CAN/CSA G164 and requirements of the following ASTM standards, with minimum coating weights or thicknesses as follows:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating of actual surface

.1 4.8 mm (3/16") and less member thickness: 600 g/sq.m (2 oz./sq.ft.).

.2 6 mm (1/4") and heavier members: 640 g/sq.m (2.1 oz./sq.ft.).

.2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in gram per square meter of surface, in accordance with Table 1 for the various classes of materials used in the Work.

3 Execution

3.1 GENERAL

.1 Verify at site that the Work to receive the work of this Section is free of irregularities detrimental to the installation and performance of the work and that it is located correctly and at proper levels before delivery and installation.

.2 Erection: To meet specified requirements of CAN/CSA-S16.

.3 Bearing Plates and Anchors: Standard.

.4 Anchors: Anchors to structural concrete shall be approved inserts set into concrete or approved self-drilling expansion insets drilled and placed afterwards.

3.2 INSTALLATION

.1 Assemble and erect work plumb, true, square, straight, level and accurate to sizes detailed, to reviewed shop drawings, free from distortion and defects detrimental to appearance and performance.

.2 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.3 Supply adequate instructions, templates, and if necessary, supervise installation of the fastenings or accessories requiring to be built-in by other Sections of the Work.

3.3 SCHEDULES

.1 Where items are required to be built into masonry, concrete or other work, supply such items to respective Sections with all anchors and accessories for building in.

.2 Itemized List: Supply and install metal work listed below unless specifically designated to be supplied only. Each item shall be as shown on drawings and as detailed on reviewed shop drawings.

.3 Miscellaneous Steel Framing, Channels, Angles, Plates and Brackets: As required and indicated on drawings.

.4 Loose Lintels:

.1 Provide and install loose lintels if not by structural steel.

.2 Finish: Hot-dip galvanized after fabrication.

.5 Under-Counter Steel Supports:

.1 Framing: Continuous channel / angle welded construction.

.2 Drill 6 mm diameter holes at each cross support for fastening of counter.

.3 Provide concealed steel section posts to support channels at front of counter, for building into wall.

.4 Provide posts with anchor plates and 9 mm diameter bolts for attachment to structure.

.5 Unless otherwise indicated, provide intermediate posts to support long counter spans.

.6 Conceal framing from view to greatest extent possible.

.7 Prime paint finish. Finish paint by Section 09 91 00.

.6 Support Framing Systems: Welded construction, complete with anchors, brackets, sleeves, screws and incidentals required to complete installations. Provide steel support for interior and exterior work including and not limited to:

.1 Shower and locker room benches.

.2 Washroom vanities.

.7 Other Miscellaneous Metal Components:

.1 General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

.2 Concealed metal angles and support not included in Division 5 section structural steel, indicated to support exterior cladding and parapets.

.3 Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

.4 Furnish inserts for units installed after concrete is placed.

.5 As required and indicated on drawings.

.6 Finish: Prime paint for interior components, ready for finishing by Section 09 90 00 – Painting and hot-dip galvanized after fabrication for exterior components.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SECTION INCLUDES

.1 Custom plastic Laminated (PLAM) Casework.

.2 Countertops.

.3 Cabinet hardware.

1.3 PERFORMANCE REQUIREMENTS

.1 Design cabinets capable of withstanding the effects of earthquake motions determined according to applicable code. Provide anchorage on cabinets exceeding 1200 mm in height or, where they are likely to be hazard from overturning.

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 mechanical, electrical and electrical rough-in, installation of associated and adjacent components.

.3 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other sections to ensure that cabinets can be supported and installed as indicated.

.1 Coordinate metal reinforcement by Section 09 21 16 – Gypsum Wallboard with mounting requirements and wall cleats for wood paneling, base and upper cabinets and accessories.

.2 Pre-installation Meeting:

.1 Convene one (1) week before starting work of this Section; conduct meeting at Project site.

.2 Require attendance of the Consultant, Installer, Manufacturer and other parties directly affected by the work of this Section.

.3 Review preparation and installation procedures, coordination and scheduling required with related work, referenced installation standards, manufacturer's installation instructions and warranty requirements.

.4 Prepare and distribute minutes of meeting to Owner and participating parties.

1.5 SUBMITTALS FOR REVIEW

.1 Product Data:

.1 Provide data for panel products, cabinet hardware and accessories, and finishing materials and processes.

.2 Shop Drawings:

.1 Indicate materials, component profiles, plans, sections and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

.2 Show locations and sizes of cutouts and holes for plumbing items, electrical wiring, switches, and outlets, and other items installed in cabinets.

.3 Samples:

.1 Provide two 300 x 300 mm samples illustrating each cabinet and shelving unit finish.

.2 Provide two 300 x 300 mm samples illustrating each countertop finish.

.3 Provide two 400 mm x 400 mm fabricated and assembled outside corner samples illustrating joinery hardwood and finish of custom.

.4 Provide two samples of drawer pulls and hinges illustrating hardware finish.

1.6 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For Fabricator and Installer.

.2 Installation Data: Provide application instructions.

.3 Inspection reports.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Woodwork Institute's (WI) North American Architectural Woodwork Standards (NAAWS), Premium Grade.

.2 Fabricator Qualifications: Company specializing in fabricating Products specified in this section with minimum five (5) years' documented experience.

.3 Installer Qualifications: Company specializing in fabricating Products specified in this section with minimum five (5) years' documented experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Protect units from moisture damage.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

2 Products

2.1 LUMBER MATERIALS

.1 Hardwood Lumber: NAAWS Premium Grade; maximum moisture content of 6 percent; of quality suitable for transparent finish, certified to FSC STD-04-004.

.2 Refer to Schedule of Finishes for basis of design natural wood species, type, and cut.

2.2 SHEET MATERIALS

.1 Sheet Products:

.1 Graded in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 4 requirements for quality grade specified;

.1 Veneer Face Grade: AA.

.2 Sheet Cores:

.1 Medium Density Fibreboard (MDF):

.1 Composed of wood fibres, medium density, FSC certified; of grade to suit application; sanded faces, formaldehyde free binder with 100% recycled and recovered fibre conforming to ANSI A208.2. Moisture resistant MDF panel to be used in all high moisture locations.

.2 Acceptable Product:

.1 Medite II by Roseburg Forest Products.

.2 MDF Excel by Uniboard.

.3 Trupan by Arauco.

2.3 LAMINATE MATERIALS

.1 Plastic Laminate (PLAM): NEMA LD3, continuous (through) colour high pressure decorative laminate (HPDL), Grade VGS; selected from manufacturer's full colour range, with matte and high gloss finishes.

.1 Multiple colours will be selected from manufacturer's premium colour collection by Consultant.

.2 Cabinet Liner: NEMA LD3, Grade CLS, not less than 0.5 mm thick.

.1 Colour: Neutral White 918 by Formica.

2.4 CASEWORK

.1 Plastic Laminate Casework:

.1 Grade: NAAWS Premium Grade.

.2 Sheet Core: Minimum 19 mm thick MDF to meet NAAWS grade specified.

.3 Construction Type: NAAWS construction type to be Frameless.

.4 Cabinet and door interface: flush overlay.

.5 Exposed Surfaces: HPDL, colour, finish and pattern direction, meeting requirements of NAAWS for Grade specified.

.6 Exposed interior surfaces: HPDL matching exposed surfaces.

.7 Semi-exposed surfaces: Cabinet liner matching exposed surfaces.

.8 Edgeband: HPDL

.1 Edgeband at doors, drawer fronts, and false fronts: 3 mm thick. Colour and texture to match casework face.

.2 Drawers: NAAWS Premium Grade:

.1 Drawer Face: Matching cabinet exposed surface finish and core material.

.2 Finish:

.1 Side back and sub-face: to match casework semi-exposed finish.

.2 Drawer face: to match casework exposed surface finish.

.3 Wall Cabinets: NAAWS Premium Grade, with finish to match base cabinets.

.1 Provide top and bottom Fillers and Corner Panels.

.2 Provide scribes and fillers with a max. 25 mm exposed dim.

.3 Underside of Cabinets: Type 'B' flush (one tight joint line visible)

.4 Provide custom valances at underside of cabinets as shown.

.5 Wall Cabinet Bulkheads: Provide custom wood paneling as shown.

.6 Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members.

2.5 SOLID SURFACING FABRICATIONS, COUNTERTOPS AND TRIM

.1 Solid Surfacing: Homogeneous filled acrylic sheets; not coated, laminated or of composite construction, superficial damage to a depth of 0.25 mm shall be repairable by sanding and polishing, semi-gloss finish with a gloss rating of 25-50.

.1 Colour: Frost 103 by Everform Solid Surface of Formica.

.2 Joint Adhesive, Solid Surfacing: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

.3 Panel Adhesive, Solid Surfacing: Manufacturer's standard neoprene-based panel adhesive.

.4 Sealant, Solid Surfacing: Manufacturer's standard mildew-resistant silicone sealant color formulated to match sheets.

2.6 PLASTIC LAMINATE COUNTERTOPS

.1 NAAWS Premium Grade.

.2 Plastic Laminate material and colour: Refer to Schedule of Finishes.

.3 Core material: Veneer core plywood for Wet Areas.

.4 Back splashes: butt joint per drawings, 102 mm high unless otherwise noted.

.5 Front edges: as per drawings.

2.7 ACCESSORIES AND AUXILIARY MATERIALS

.1 Adhesive: Type recommended by NAAWS to suit application.

.2 Fasteners: Size and type to suit application.

.3 Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; nickel plated finish in concealed locations and stainless steel finish in exposed locations.

.4 Concealed Joint Fasteners: Threaded steel.

.5 Tape: Aluminum foil, insulating and heat dissipating tape. Use butyl tape for isolating wood from masonry or cementitious materials.

.6 Steel Sections for Counter Supports: As specified in Section 05 50 00 – Metal Fabrications.

2.8 HARDWARE

.1 General: Manufacturer’s products specified or indicated represent standard of quality required. Provide specified or indicated products or approved alternative products having the same functional and appearance characteristics and conforming to or exceeding the requirements of CAN/CGSB-69.25/ANSI/BHMA A156.9.

.2 Metal Hardware Finish: Nickel plate, unless otherwise specified.

.3 Hardware for 19mm Thick Doors:

.1 Hinges: 170 degree swing, soft close, unless indicated otherwise, fully concealed, all metal; Product: Blum 90 series or Euromat Series by Hettich International.

.4 Cabinet Door Pivot Hinge:

.1 Hinges: 270 degree swing, unless indicated otherwise, all metal; Product: 344.06.900 Aximat 300 TM Institutional Hinge by Häfele Co.

.5 Drawer Slides: Electro-plated zinc screw mounted, heavy duty, full extension type with captive profile to eliminate side movement, soft close, positive in and out stops and, load capacity to suit drawer size with minimum static load rating of 27 kg for drawers 150 mm and less, and 40 kg for drawers over 150 mm in depth, lengths to suit application, side-mounted type.

.1 Product: Metabox 320 Series by Blum, Accuride Series 3832EC by Richelieu, or approved equivalent.

.6 Drawer and Door Bumpers: Permanently fixed polyurethane type, clear colour.

.7 Pulls:

.1 Swing Door Pulls: U shape, satin stainless steel finish 400 mm high.

.8 Shelf Supports:

.1 Pin shelf support: Nickel-plated steel pin shelf support, 5 mm diameter; Product: No. 282.38.708 by Hafele or approved equivalent.

2.9 FABRICATION

.1 Fabricate to NAAWS Grade standards indicated in Part 2.

.2 Shop prepare and identify components for matching during site assembly.

.3 Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

.4 When necessary to cut and fit on site, provide materials with ample allowance for site cutting and scribing.

.5 Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit

.6 Provide cut-outs for plumbing fixtures and fittings. Verify locations of cut-outs from site dimensions. Seal cut edges.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify adequacy of backing and support framing.

.3 Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

.1 Install Work in accordance with NAAWS Premium Grade.

.2 Set and secure casework in place; rigid, plumb, and level. Provide anchoring to conform to seismic requirements.

.3 Use fixture attachments in concealed locations for wall mounted components.

.4 Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

.5 Carefully scribe casework abutting other components, with maximum gaps of 1 mm. Do not use additional overlay trim for this purpose.

.6 Secure cabinet counter bases to floor using appropriate angles and anchorages.

.7 Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

.8 Isolate wood members in contact with masonry or cementitious construction with butyl tape.

.9 At junctions of counter and back splash and at junctions of cabinets and adjacent wall finishes, apply small bead of clear silicone sealant.

3.3 ADJUSTING

.1 Test installed work for rigidity and ability to support loads.

.2 Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

.1 Clean installed work.

.2 Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This section include supply and installation of sealants and joint backing materials as required for the Work.

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C509, Standard Specifications for Elastomeric Cellular Performed Gasket and Sealing Material

.2 ASTM C510, Standard Test Method for Staining and Color Change of Single-or Multicomponent Joint Sealants.

.3 ASTM C920, Standard Specification for Elastomeric Joint Sealants.

.4 ASTM C1021, Standard Practice for Laboratories Engaged in Testing of Building Sealants.

.5 ASTM C1184, Standard Specification for Structural Silicone Sealants.

.6 ASTM C1193, Standard Guide for Use of Joint Sealants.

.7 ASTM C1248, Standard Test Method for Staining of Porous Substrate by Joint Sealants.

.8 ASTM C1330, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.9 ASTM D5893/D5893M, Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

1.5 SUBMITTALS

.1 Provide submittals in accordance with the General Conditions and Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Manufacturer's Data: Submit manufacturer's literature describing each material to be used in the work of this Section. Literature shall contain a statement that the material complies with the specified standard.

.2 Structural Sealant Joint Design: Provide calculations for structural bite, dead load support, glueline thickness, shear, and other parameters. Include confirmation that design data provided by Consultant have been reviewed and approved by sealant manufacturer.

.3 Samples: Submit for approval and colour selection sample of each type of compound, recommended primers and joint filler or fillers proposed to be used.

.3 Submittals for Information:

.1 Qualifications Data: For Manufacturer and Installer.

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

.1 Indicate special procedures, surface preparation, perimeter conditions requiring special attention, and field quality control testing.

.3 Field reports.

.1 Site quality control report identifying procedures for site testing and verification.

.2 Manufacture site service report identifying materials have been installed in accordance with manufactures recommendations.

1.6 QUALITY ASSURANCE

.1 Applicator qualifications:

.1 Execute Work by applicators trained and approved by the manufacturer and having 5 years proven experience.

.2 Independent inspection and testing agency:

.1 Qualification: In accordance with ASTM C1021.

.2 Conduct field inspection and testing of sealant with the manufacturer's representative for a minimum of 5% of joints, including mixing of materials, joint preparation, priming, joint profile and thickness, application, adhesion, cohesion, and tooling.

.3 Prepare and submit inspection and test report results after each inspection. Include confirmation by the manufacturer that installation has been satisfactorily completed.

.3 Manufacturer's representative:

.1 Review Site conditions, joint design, and installer's qualifications. Report unsatisfactory conditions to Consultant.

.2 Check container labels, inspect preparation of substrate materials and review installation procedures 48 hours in advance of installation, and randomly test installed Work.

.4 Pre-installation meetings:

.1 Conduct meetings 7 Days in advance of sealant installation.

.2 Include Consultant, sealant manufacturer's representative, independent inspection and testing agency engaged by Contractor, and parties who are directly affected by the Work of this Section.

.3 Verify Contract requirements, substrate conditions, joint conditions and profile, weather conditions, and the manufacturer's installation instructions.

.4 Within 72 hours following the pre-installation meeting, prepare a pre-installation meeting report and issue to all parties in attendance.

.1 Clearly indicate the recommendations made during the pre-installation meeting, the required actions, and by whom.

1.7 SITE CONDITIONS

.1 Apply sealants only to completely dry surfaces, and at air, substrate and material temperatures above minimum established by manufacturer's written specifications.

1.8 DELIVERY, STORAGE HANDLING AND PROTECTION

.1 Deliver all materials to the jobsite in their original, unopened containers, with all labels intact.

.2 Receive and store materials as recommended by materials manufacturer.

.3 Maintain containers and labels in undamaged condition.

1.9 WARRANTY

.1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.

.1 Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

.2 Provide manufacturer's twenty-year material warranty for installed silicone sealant.

2 Products

2.1 MATERIALS – SEALANTS

.1 Type A:

.1 Single component, non-sag, non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 To match adjacent substrate.

.3 Manufacturer’s Products:

.1 DOWSIL™ Contractors Weatherproofing Sealant (CWS) by Dow.

.2 Tremsil 400 by Tremco Sealants.

.3 Sikasil-N plus by Sika Canada Inc.

.4 SWS by GE Silicones.

.5 Pecora PCS by Pecora Corporation.

.2 Type C:

.1 Anti-microbial (mildew-resistant), non-paintable, silicone joint sealant, in accordance with ASTM C920, Type S, Grade NS, minimum Class 25, and non-staining when tested in accordance with ASTM C510 or ASTM C1248.

.2 Colour:

.1 Clear/translucent.

.3 Manufacturer’s Products:

.1 DOWSIL 786 by Dow.

.2 Tremsil 200 by Tremco Sealants.

.3 Sikasil-GP/GP HT by Sika Canada Inc.

.4 SCS1700 Sanitary by GE Silicones.

.5 Pecora 898NST by Pecora Corporation.

2.2 ACCESSORIES

.1 Primers:

.1 Type recommended by sealant manufacturer for substrate, to promote adhesion and to prevent staining of adjacent surfaces for conditions encountered.

.2 Joint backing:

.1 Extruded, round, solid section, skinned surface, closed cell, soft polyethylene foam gasket stock, compatible with primer and sealant materials.

.2 30% to 50% oversized.

.3 Shore A hardness of 20, tensile strength 140 kPa to 200 kPa, in accordance with ASTM C1330.

.4 Bond breaker type surface.

.3 Bond breaker tape:

.1 Polyethylene tape or other plastic tape recommended by sealant manufacturer to prevent sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint.

.2 Provide self-adhesive, pressure sensitive tape where applicable.

.3 Do not use material impregnated with oil, bitumen, non-curing polymer or similar deleterious material.

.4 Cleaning agents:

.1 Recommended by sealant manufacturer.

.2 Free of oily residues or other substances capable of staining or harming joint substrates and adjacent surfaces.

.5 Masking tape:

.1 Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

3 Execution

3.1 INSPECTION

.1 Verify at site that joints and surfaces conditions provided will not adversely affect execution, performance or quality of completed work.

.2 Ensure masonry and concrete have cured 28 days minimum.

.3 Ascertain that sealers and coatings applied to substrates are compatible with sealant used and that full bond of the sealant and substrate is attained. Request samples of the sealed or coated substrate from their fabricators for testing of compatibility and adhesion, if necessary.

.4 Verify that specified recommended environmental conditions are present before commending work.

.5 Defective work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the work of this section.

.6 Do not start work of this Section until conditions are satisfactory.

3.2 PREPARATION

.1 Clean joint surfaces using joint cleaner as necessary, to remove dust, paint, loose mortar, and other foreign matter and dry joint surfaces.

.2 Remove dust, silt, scale and coatings from ferrous metals by wire brush, grinding or sandblasting.

.3 Remove oil, grease and other coatings from non-ferrous metals with approved cleaning solvent.

.4 Ensure surfaces are free of frost, rust, lacquers, laitance, release agents, moisture or other matter which might adversely affect adhesion of sealant.

.5 Examine joint sizes and correct as required to allow for anticipated movement and to achieve proper width/depth ratio per manufacturer's written recommendations for specified sealant.

.6 Support joint filler on horizontal traffic surfaces against vertical movement which might result from traffic loads or foot traffic.

.7 Prepare surfaces as recommended by sealant manufacturer.

.8 Fully remove existing sealant scheduled to be removed and replaced with new sealant, in areas indicated on the Drawings.

.1 Follow manufacturers procedures for removal of existing sealant and test areas for adhesion of new sealant. Provide the Consultant with field report identifying results of adhesion testing.

.9 Install joint backing material or apply bond breaker tape to achieve correct joint depth and prevent three-sided adhesion.

.10 To protect adjacent surfaces, mask adjacent surfaces with tape prior to priming and/or sealing.

.11 Prime sides of joints using two cloth method in accordance with manufacturer's directions immediately prior to sealing.

.12 Before any sealing is commended, a test of the material shall be made for indications of staining, poor adhesion or other undesirable effects.

.13 Seal joints in surfaces to be painted before painting. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure prime paint is compatible with primer and sealant. If incompatible inform Consultant, consult the manufacturer, and change primer and sealant to approved compatible types.

.14 Check form release agent used on concrete for compatibility with primer and sealant. If incompatible inform Consultant and change primer and sealant to approved compatible types or clean concrete to Consultant's approval.

3.3 INSTALLATION

.1 Perform Work in accordance with manufacturer’s recommendations for Products and applications indicated, unless more stringent requirements apply.

.2 Use Products without additives or adulteration. Use one manufacturer's Product for each location in accordance with Sealant Location Schedule at end of this section.

.3 Perform Work in accordance with ASTM C1193, and ASTM C919 for Acoustic Sealant.

.4 Joint backing:

.1 Install joint backing to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

.1 Depth of recess: Maintain 2:1 joint width to depth ratio.

.2 Where recess is less than specified depth, cut back surface of recess to specified depth.

.2 Do not leave gaps between ends of joint backings.

.3 Do not stretch, twist, puncture, or tear joint backings.

.4 Remove absorbent joint backings that have become wet before sealant application and replace with dry materials.

.5 Support joint backing on horizontal surfaces against vertical movement which might result from pedestrian or vehicular traffic loads.

.5 Install bond breaker tape between sealant and back of joints where joint backing is not used.

.6 Apply sealant immediately after adjoining Work is in condition to receive sealant Work and as follows:

.1 Apply sealant in a continuous bead using gun with correctly sized nozzle. Use sufficient pressure to completely fill joint recess.

.2 Ensure sealant has full, direct uniform contact with, and adhesion to, side surfaces of recess. Superficial pointing with skin bead is not acceptable.

.7 Tooling:

.1 Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified to form smooth, uniform sealant bead, free from ridges, wrinkles, sags, air pockets, embedded impurities, dirt, stains, or other defects.

.2 At recesses in angular surfaces, finish sealant with flat profile, flush with face of material at each side.

.3 At recesses in flush surfaces, finish sealant with concave face and flush with face of material at each side.

.8 Immediately remove excess sealant and droppings.

.9 Ensure sealant bead is uniform in colour.

.10 Cure in accordance with the sealant manufacturer's recommendations. Do not cover up sealants until proper curing has taken place.

.11 Remove defective sealant and reapply.

3.4 SITE QUALITY CONTROL

.1 Joint Sealants: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1193, Method A – Field-Applied Sealant Joint Hand Pull Tab.

.1 Perform test no later than 21 days after installation at a rate of one test every 300 m of installed sealant.

.2 Structural Sealant: Perform adhesion tests on exterior sealants in accordance with manufacturer's written instructions and ASTM C1401, Method B – Hand-Pull Tab (Non-destructive).

.1 Perform five tests for first 300 meters of applied silicone sealant and one test for each 300 meters seal thereafter or perform one test per floor per building elevation minimum.

.2 For sealant applied between dissimilar materials, test both sides of joint.

.3 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.

.4 Maintain test log and submit report to Consultant indicating tests, locations, dates, results, and remedial actions.

.5 Maintain record of conditions and temperatures during application.

3.5 MANUFACTURER'S SITE SERVICES

.1 Require site attendance of each sealant manufacturers, during installation of the Work. Start sealant application in presence of manufacturer's technical representative.

.2 Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

.1 Clean surfaces adjacent to joints. Immediately remove sealant smears or other soiling resulting from application of sealants.

.2 Remove masking tape and other residue.

.3 Do not mar or damage finishes on materials adjacent to joints. Repair or replace marred or damaged materials.

3.7 PROTECTION

.1 Protect joint sealants:

.1 During and after curing period from contact with contaminating substrates.

.2 From damages by construction operations or other causes.

.2 If damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated sealants immediately.

3.8 SEALANT LOCATIONS SCHEDULE

Sealant Locations Schedule

Type A	Above grade level, vertical applications
	- General perimeter caulking (window, doors and frames, louver frames, shelf angles, thresholds, bedding of mullions, precast and tilt-up panels). - Vertical expansion, control, lap joints application. - Painted metals. - Mullion joints. - Interior partition head to structure above. - Interior metal frames joints. - Exterior metal flashing. - Locations not indicated on Contract Drawings and required sealant for Work.

Type C	Above grade level, horizontal and vertical applications
	- Around sinks, urinals, and bathroom fixtures. - Tiled areas' horizontal and vertical control and expansion joints. - Between vanity and mechanical fixtures/fittings. - Between access panels and tiles. - At corners of tiled walls.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of the following:

.1 Interior Steel Doors and Frames

1.3 DEFINITIONS

.1 Base Metal Thickness: Thickness dimensions are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic coated steel sheets.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American National Standards Institute (ANSI):

.1 ANSI/SDI A250.7, Nomenclature for Standard Steel Doors and Steel Frames

.2 ANSI/SDI A250.11, Recommended Erection Instructions for Steel Frames.

.3 American Society for Testing and Materials (ASTM):

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

.2 ASTM A879/A879M, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface

.3 ASTM A924/A924M, Standard Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 1.132, Primer, Zinc Chromate, Low Moisture Sensitivity

.5 Canadian Standards Association (CSA):

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

.6 Canadian Steel Door Manufacturers Association (CSDMA):

.1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2007

1.5 SUBMITTALS

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

.2 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data:

.1 Submit product data for each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, fire resistance ratings, and finishes.

.2 Shop Drawings:

.1 Show each type of frame, door, hardware blanking, reinforcing, tapping and drilling arrangements, metal gauges, thicknesses and finishes.

.2 Show details of doors including vertical and horizontal edge details.

.3 Submit door and frame schedule identifying each unit. Each unit shall bear a legible identifying mark corresponding to that listed in the door and frame schedule.

.3 Samples:

.1 Supply for Consultant's review, if requested, sample of frame corner showing construction, workmanship and finish.

.4 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Source Quality Control Submittals: Submit information on zinc coating treatment and primer spot treatment, including instructions for surface treatment before site painting and any restrictions or special coating requirements.

.5 Certificates: Submit the following certificates or letters of compliance:

.1 Oversize Compliance: Submit oversize construction evidence indicating compliance with fire labelling for door and frame assemblies required to be fire protection rated and exceeding size limitations of labelled assemblies.

1.6 QUALITY ASSURANCE

.1 Manufacturer: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer, and as follows:

.1 Fabricate work of this Section to meet the requirements of the Canadian Steel Door and Frame Manufacturer's Association, Manufacturing Specification for Doors and Frames as a minimum, and as further modified in this section.

.2 Fabricator shall be a member in good standing of the Canadian Steel Door and Frame Manufacturer's Association.

.2 Supplier: Obtain hollow metal doors and frames from single source of supply and from a single manufacturer.

.3 Installer: Use installers who are experienced with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Adequately protect units against rust and damage during manufacture, delivery and storage.

.3 Store materials on planks in a dry area and cover to protect from damage. Make good immediately any damage done. Clean scratches and touch-up with rust-inhibitive primer.

1.8 SITE CONDITIONS

.1 Site Measurements: Verify actual dimensions of openings by site measurements before fabrication and indicate measurements on shop drawings; coordinate fabrication schedule with construction progress to avoid delaying the Work.

.2 Established Measurements: Establish dimensions and proceed with fabricating doors and frames without site measurements where site measurements cannot be made without delaying the Work; coordinate construction to ensure that actual site dimensions correspond to established dimensions.

2 Products

2.1 MATERIALS

.1 Sheet Steel:

.1 Interior Doors and Frames: Metallic Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum ZF120 (A40) zinc-iron-alloy (galvannealed) coating designation.

.2 Steel Gauges:

.1 Door and Screen Frames: 1.60 mm (16 msg)

.2 Doors (Honeycomb or Polystyrene Core):

.1 Door Faces: 1.30mm (18 msg).

.3 Top and Bottom End Channels: 1.30mm (18 msg).

.4 Reinforcements:

.1 Lock and Strike Reinforcements: 1.60mm (16 msg).

.2 Hinge Reinforcements: 3.51mm (10 msg).

.3 Flush Bolt Reinforcements: 1.60mm (16 msg).

.4 Door Closer or Holder Reinforcements: 2.74mm (12 msg).

.3 Anchors: As required to suit condition.

.4 Rubber Bumpers: 3 per door.

.5 Door Cores:

.1 Honeycomb Core: Structural small cell; 25 mm (1") maximum, kraft paper honeycomb; minimum weight 36 kg/ream; minimum density 16.5 kg/m^3; sanded to required thickness.

.6 Core Adhesive: Heat resistant, single component adhesive recommended by manufacturer.

.7 Touch-Up Primer: Rust inhibitive primer meeting CAN/CGSB 1.132, touch up zinc coatings using shop applied primer; grey or red coloured primer, clear primer not acceptable; provide additional primer for site touch-up to repair damaged zinc and shop applied coatings.

.8 Accessories:

.1 Sealant: As specified in Section 07 92 00 – Sealants.

.2 Door Silencers (Bumpers or Mutes): Manufacturer's standard black or grey neoprene silencers; three silencers on strike jambs of single door frames; two silencers on heads of double-door frames; stick on bumpers are not acceptable.

2.2 FABRICATION AND MANUFACTURE

.1 Gauges of metal shall be as specified. No deviations or substitutions will be accepted

.2 Reinforcing specified is the minimum acceptable. Provide additional reinforcement where required to ensure a permanent, rigid, trouble free installation able to withstand the stresses of heavy commercial usage.

.3 Cut, shear, straighten and work the steel in manner to prevent disfigurement of the finished work.

.4 Punch frames for rubber door bumpers.

.5 Fill seams, joints and weld depressions with epoxy metal filler, disc sand to a smooth, flat, uniform scratch-free surface, with all arrises sharp and true to line. Drilled and punches holes shall be reamed and have all burrs removed.

.6 Finished work shall be free of warp, open seams, buckles, weld and grind marks and other surface defects detrimental to the production of a good paint finish.

.7 Fastenings shall be concealed except those required for loose glazing stops.

.8 Welding shall conform to CSA W59.

.9 Hardware Requirements:

.1 Blank, mortise, reinforce, drill and tap doors and frames to receive templated hinges and other hardware as required. Check hardware lists for requirements.

.10 Frames:

.1 Fabricate frames to profiles shown. Frames shall be fabricated to suite the header conditions of masonry work. Mitre corners of frames. Cut frame mitres accurately and weld continuously on inside of frame. Fabricate header frame to suit. Where site welding or splicing is required due to size of unit, the location of field joints shall be shown on the shop drawings and strictly adhered to.

.2 Protect strike and hinge reinforcements and other openings with mortar guard boxes welded to frame.

.3 Cutouts in doors for mortise lock sets shall be fitted with leaf spring clips and back limit stop to facilitate easy positioning and setting of locksets.

.4 Weld floor clip angles to inside of each jamb profile, two holes in each for anchorage to floor. Where required provide adjustable type floor clip angles.

.5 Fit frames with channel or angle spreaders, two per frame, to ensure proper frame alignment. Install stiffener plates or spreaders between frame trim where required, to prevent bending of trim and to maintain alignment when setting and during construction.

.6 Where frames occur in masonry provide and adjustable T-strap type or wire type anchor for every 610mm (2'-0") of jamb length. Special anchors for frames to be set in concrete shall be as detailed.

.7 Construct door frames of labelled fire doors as approved by ULC or ULI. Ratings for frames shall match doors. Locate label on the frame jamb midway between the top hinge and the head of door frame so that it is concealed when the door is closed.

.8 Provide continuous weatherstripping at head and jambs of exterior door frames. Properly secure in place with screws and adjust as required.

.9 Insulate exterior frames to provide continuous thermal barrier in exterior frames.

.11 Doors:

.1 Fabricate doors to present one continuous face free from joints, tool markings and abrasions.

.2 Reinforce, stiffen honeycomb doors with small cell honeycomb core laminated to the inside faces of panels. The core shall completely fill the inside hollow of the door.

.3 Reinforce around frame openings required for glazing or louvers. Provide glazing stops with countersunk oval head screws.

.4 Exterior doors shall be completely filled with polystyrene foam core.

.5 Reinforce door edges with channel reinforcing. Bevel stiles 3 mm (1/8"). Assemble by tack welding and fill.

.6 Provide flush top edge on exterior doors.

.7 Fabricate fire rated door assemblies in accordance with ULC or ULI requirements. Provide labels for all fire rated doors. Locate label on the door midway between the top hinge and the head of the door so that it is concealed when the door is closed.

.8 Provide cutouts in doors for glazed lites as indicated on drawings and schedules. Glazing stops shall be square formed steel in single piece lengths sized to suit. Accurately mitre corners and finish in proper plane. Secure stops in place with flush, countersunk screws.

.12 Finishing

.1 Shop apply zinc rich primer to repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site; include compatible primer for site finishing and correction of surface abrasions to zinc coatings and factory applied primer.

.2 Remove weld slag and splatter from exposed surfaces.

.3 Fill and sand smooth tool marks, abrasions and surface blemishes to present smooth uniform surfaces.

3 Execution

3.1 EXAMINATION

.1 Examine substrates, door swing arcs, areas of installation and conditions affecting installation for compliance with requirements for manufacturer's installation tolerances and other conditions affecting performance of work of this Section.

.2 Verify roughing-in for embedded and built-in anchor locations before installing frames.

.3 Verify door and frame size, door swing and ratings with door opening number before installing frames.

.4 Installation of hollow metal doors and frames will denote acceptance of site conditions.

3.2 INSTALLATION

.1 Install steel doors, frames, and accessories in accordance with reviewed shop drawings, ANSI A250.11, CSDMA Installation Guide, manufacturer's data, and as specified in this Section.

.2 Door Frames:

.1 Remove temporary spreaders before installing door frames, leaving exposed surfaces smooth and undamaged.

.2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm (1/16") out of plumb measured on face of frame, maximum twist corner to corner of 3 mm (1/8"); align horizontal lines in final assembly.

.3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 1220mm (4') and wider in accordance with ANSI A250.1; do not use temporary metal spreaders for bracing of frames.

.4 For frames over 1220mm (4') in width, provide vertical support at the centre of head.

.3 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:

.1 Squareness: Maximum 0.8mm (1/32") measured across opening between hinge jam and strike jamb.

.2 Plumbness: Maximum 0.8mm (1/32") measured from bottom of frame to head level.

.3 Alignment: Maximum 0.8mm (1/32") measured offset between face of hinge jamb and strike jamb relative to wall construction.

.4 Twist: Maximum 0.8mm (1/32") measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.

.4 Doors:

.1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation.

.2 Install hardware in accordance with manufacturers' templates and instructions.

.3 Adjust operable parts for correct clearances and function.

.5 Adjusting and Cleaning

.1 Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of air-drying primer compatible with factory applied primer, and as follows:

.1 Clean exposed surfaces with soap and water to remove foreign matter before site touch-up.

.2 Finish exposed site welds to a smooth uniform surface and touch-up with site applied rust inhibitive primer.

.3 Site apply touch-up primer on exposed surfaces where zinc coating or factory applied primer has been damaged during installation or handling.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Provision of all labour, materials, equipment and incidental services necessary to supply finish hardware, including the following:

.1 Supply and delivery to the project all items of architectural finishing hardware specified herein,

.2 Supply and installation of low-energy door operators and hardware,

.3 Supply and installation of all electrical hardware items including, but not limited to; low voltage wire (FT6 plenum-rated when not in conduit), maglocks, electric strikes, electric exit devices, current transfer devices, wall switches, jamb switches, keypads, controllers, power supplies, and

.4 Completion of all low voltage terminations by the hardware supplier

1.3 RELATED REQUIREMENTS

.1 Coordinate with Work of other Sections having a direct bearing on Work of this Section.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 Standards:

.1 ANSI-A250.4 - Steel Doors and Frames Physical Endurance

.2 ANSI A156.1 - Butts and Hinges

.3 ANSI A156.4 - Door Controls - Door Closers

.4 ANSI A156.6 - Architectural Door Trim

.5 ANSI A156.15 - Closer Holder Release Devices

.6 ANSI A156.18 - Material and Finishes

.3 CODES

.1 NFPA 101 - Life Safety Code

.2 OBC 2012 - Ontario Building Code

1.5 DEFINITIONS

.1 Architectural Hardware Consultant (AHC): person or persons skilled in selecting, coordinating and specifying architectural hardware, and certified by the Door and Hardware Institute.

.2 Hardware Supplier: company or group of companies whose purpose is the manufacture and supply of architectural finish hardware.

.3 Hardware Distributor: company whose purpose is the distribution of architectural finish hardware.

1.6 QUALITY ASSURANCE

.1 Products

.1 Products specified herein are minimum standard. Approved substitutions are listed. Products proposed as substitutions must be accepted by addenda prior to Bid Closing.

.2 Hardware for doors in fire separations and exit doors must be certified by a Canadian Certification Organization accredited by Standards Council of Canada. Supply only ULC and/or CSA listed electrical components.

.3 Hardware Suppliers

.1 Hardware Suppliers must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.

.2 The Hardware Supplier will provide following services to the Contract:

.1 preparation of the hardware schedule issued for tender,

.2 review of all shop drawings,

.3 provision of requested samples,

.4 review of hardware substitution submittals, and

.5 provision of all inspections and reports as specified herein.

.4 Hardware Distributors

.1 The Distributor must have a minimum of five (5) years documented experience in the supply of Finish Hardware for similar projects.

.2 Hardware Distributors must have in their employ a certified Architectural Hardware Consultant (AHC) certified by the Door and Hardware Institute.

.3 The Hardware Distributor will assume responsibility that the Products supplied under this section meet or exceed the minimum requirements of the specifications, the hardware schedule, and all authorities having jurisdiction.

.5 Installers

.1 Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. The Contractor shall provide verification of installer's qualification to the Consultant for approval. Installers to attend all review meetings with the Hardware Supplier and Distributor.

.6 Pre-installation Meeting

.1 Convene a pre-installation meeting for the work specified in this section. Attendees must include, as a minimum, representatives of the following:

.1 Contractor (Site Superintendent & Project Manager)

.2 Installation Subcontractor (Site Foreman & Project Manager)

.3 Hardware Supplier (AHC)

.4 Hardware Distributor (AHC and Installer)

.5 Consultant

1.7 SUBMITTALS

.1 Updated Finish Hardware Schedule

.1 Prepare and submit complete detailed hardware schedules prepared in 216mmx279mm DHI format.

.2 Product Data

.1 Provide in a three D-ring binder of product data sheets with the finish hardware schedule showing all items of hardware to be used on the project.

.3 Samples

.1 When requested in writing, provide one sample of each hardware item requested complete with fasteners to the office of the Consultant. Samples to be clearly labeled with their hardware schedule designation and manufacturers' name and model number. Samples may be incorporated into the Work.

.4 Templates

.1 Provide two (2) complete sets of hardware templates for related fabricating and installation.

.5 Keying Schedule

.1 Provide keying schedule for review. Include all special keying notes and stamping instructions. Locks and cylinders are not to be ordered until the key schedule has been approved by the Owner.

.6 Operations and Maintenance Data

.1 Prior to Substantial Performance, provide two (2) copies of the following information for inclusion in Operation And Maintenance Manuals:

.1 Maintenance instructions for each hardware item,

.2 Catalogue cut sheets and Product Specifications or each product,

.3 Parts list for each product,

.4 Copy of final "as-built" finish hardware schedule, and

.5 Copy of final keying schedule.

.7 Maintenance Materials

.1 Provide the following maintenance materials:

.1 Five (5) of each installation tool used for locks/passage/privacy, all type of door closers, and all exit devices.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver each hardware item in its original package complete with all fasteners, keys, templates, and installation instructions required for installation.

.2 Package hardware separately for each door or unit and state clearly on each package the number and description of the door or unit for which the hardware therein is intended. Group items accordingly.

.3 Clearly mark each container with the door opening number and the hardware schedule item or heading number.

.4 Store hardware in a locked room or other secure area, accessible by only the Contractor. Storage area must contain adequate storage provision to hold all hardware off the floor (temporary shelving or wood pallets). Ensure area is kept dry and clean.

.5 When requested, package items of hardware separately for delivery to other fabricators for their installation.

.6 Deliver and assist in unloading and sorting of hardware. All hardware must be checked in on site by the Contractor's Site Supervisor.

1.9 COORDINATION WITH OTHER TRADES

.1 Supply finish hardware to those who are to install it, complete with templates and other complete installation instructions in sufficient time to avoid delaying the progress of the work.

.2 Supply complete templates and instructions to all door and frame manufacturers for factory machining of products to receive Hardware.

1.10 INSPECTION

.1 Hardware Distributor must perform the following inspections:

.1 Check all hardware when it has been installed and notify the Consultant of improper installation, defective materials, or products installed that were not specified. Replace defective hardware promptly.

.2 Check all door closers after they have been installed to make sure that all adjustments such as back-checking degree have been properly made. Notify the Consultant of any closers which have not been properly adjusted.

1.11 MAINTENANCE

.1 Maintenance Service

.1 Following occupancy of the building by the Owner, arrange with the Owner's maintenance staff for instruction of proper use, servicing, adjusting and lubrication of all finish hardware. Submit to the Consultant a list of attendees and meeting date.

1.12 EXTENDED WARRANTIES

.1 Provide the following manufacturer's warranties beyond the date of expiration of the Contract warranty:

.1 Hinges - Lifetime

.2 Door closers - Ten (10) years

2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Subject to conformance to requirements provide hardware manufactured by the following:

.1 Dorma Group of Companies.

.2 ASSA-ABLOY Group of Companies.

.3 Allegion Group of companies.

2.2 MATERIALS

.1 Fabricate all hardware to template. Provide templates and template hardware together with the instructions necessary for door and frame preparation.

.2 Supply all hardware with necessary screws, bolts or other fastening devices to anchor hardware in position neatly and properly in accordance with best practices.

.3 Only products listed in the hardware schedule or the approved alternates noted in the following list are to be used on this project.

.4 Use one manufacturer's products only for all similar items.

.5 All exterior doors shall be fitted with complete perimeter weatherstripping and threshold where not provided by door or frame manufacturer.

.6 No substitutions are allowed for the following products, due to integration with existing hardware:

.1 Door Closers.

2.3 FASTENINGS

.1 Supply all required bolts, screws, expansion shields, anchors, and other related accessories for satisfactory attaching or installing of all finish hardware.

.2 Exposed fasteners shall match finish of, and be of compatible material with hardware.

.3 Where push/pull hardware is scheduled, door pull must be through-fastened and have fasteners concealed by push plate on opposite side.

2.4 HINGES

.1 Butt Hinges: ANSI/BHMA-A156.1, Grade 1.

.1 Supply hinges with non-removable pin (NRP) option on all doors where the hinge barrel is exposed on the secured exterior side of the door.

.2 Use two hinges on doors up to 1525mm and an additional hinge for each additional 760mm or fraction thereof.

.3 Doors 914mm wide and less: 114mm high hinges; doors greater than 914mm to 1220 mm wide: 127mm high hinges; all standard weight.

.4 Supply standard weight and heavy weight concealed bearing hinges on all doors equipped with door closers; ferrous (steel) material for all interior and/or fire-rated doors and stainless steel for exterior doors as listed in the hardware groups.

2.5 DOOR CLOSERS

.1 Door closers to be Grade 1 ANSI/BMHA A156.4, and have the following features (see separate closer sections below for further information):

.1 Fully hydraulic, rack and pinion action with high strength cast iron cylinders and one piece forged steel pistons.

.2 Hydraulic fluid of a type requires no seasonal adjustments, and has constant temperature control from 49^{o}C to –35^{o}C.

.3 Hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.

.4 Separate adjustments for backcheck, general speed and latch speed.

.5 Include high efficiency, low friction pinion bearings.

.6 Size 1 manual door closers to provide less than 22N opening force on a 914mm door leaf.

.7 Closers with painted finishes shall exceed a minimum 100-hour salt spray test, as described in ANSI/BHMA-A156 and ASTM B117.

.8 Closers detailed with plated finishes shall include plated covers (or finish plates), arms and visible fasteners.

.9 Provided with all mounting plates required to mount on any special door and frame conditions.

.2 Heavy Duty Mechanical (Multiple Applications)

.1 ANSI/BHMA-A156.4, non-sized (1-6) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft and certified to exceed ten million (10,000,000) full load operating cycles by a recognized independent testing laboratory with power-adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have stamped main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

2.6 DOOR OPERATORS

.1 Heavy Duty Electric Operator (Push Side Mount)

.1 ANSI/BHMA-A156.19, non-sized (2-5) and non-handed cylinder body to have 38mm piston diameter with 17.5mm double heat-treated shaft. With forged steel main arm. Power operator to include:

.1 Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical code.

.2 Second Chance Function: program within the on-board computer monitoring resistance during opening cycle. If resistance is present operator pauses for a few seconds, then attempts to open door again. If resistance does not exist door will open normally. However if resistance still exists, door will pause and the unit will time out and door will close.

.3 Breakaway Drive System: System within the motor/clutch assembly. If the door is forced closed while in the opening cycle, the clutch slips preventing damage to the operator, door and frame.

.4 Soft Start Motor Control: required for controlled start once actuator is depressed to extend the service life of all drives components.

.5 Built in Power Supply to deliver 12V and 24V outputs up to a maximum of 1.0 amp.

.6 Certified by ULC for use on labeled doors.

.7 Independent adjustments for all electrically controlled functions within controller module.

.2 Actuators

.1 Wall Type

.1 Wall plate switch to be hard-wired either 12V DC or 24V DC actuator with round, stainless steel touch plate in either 114mm or 152mm diameters. Engraved blue filled handicap symbol conforms to most accessibility codes. Units to include heavy grade components for vandal resistant mounting and weather resistant switch standard.

.3 Low energy door operators will be supplied and installed by factory trained installers. Hardware supplier will coordinate the installation of the door operators and include the cost of labour for this work.

2.7 PULLS AND PLATES

.1 Supply door trim as listed in hardware schedule. Supply pulls with back to back (BTB) or through bolt mounting as required. When push plates are listed with door pulls, install the push plate to conceal the through bolt.

.2 All kickplates, push plates, and bumper plates must have all sides beveled and corners rounded to ensure no sharp edges. Supply plates with counter sunk screw holes. Supply double-sided tape for adhesive-mount.

.3 Kick plates will be minimum 0.127mm thick unless listed otherwise; size to be door width less 35mm for single door, and less 25mm for pairs of doors. Heights as scheduled.

2.8 DOOR STOPS AND HOLDERS

.1 Overhead stops and mechanical holders shall be surface mounted unless a conflict exists with door closers or other hardware. Provide door stays with friction action in locations that do not have door closers. Install all overhead stops and holders for 90° stop unless otherwise specified.

2.9 FINISHES

.1 Finishes are specified as follows:

.1 As indicated on Finish hardware schedule.

3 Execution

3.1 EXAMINATION

.1 Ensure that doors and frames are properly prepared and reinforced to receive finish hardware prior to installation.

.2 Ensure that door frames and finished floor are sufficiently plumb and level to permit proper engagement and operation of hardware.

3.2 INSTALLATION

.1 Install hardware to ANSI/DHI-A115.1G.

.2 Install hardware at mounting heights as specified in the manufacturer's templates or specific references in approved hardware schedule or approved elevation drawings. Where mounting height is not otherwise specified herein, install hardware at the following mounting heights:

.1 Push/Pull: 1065mm.

.3 Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

.4 Follow all manufactures installation instructions. Adjustment is inclusive of spring power, closing speed, latching speed and back-check at the time of installation.

.5 Install head seal prior to installation of parallel arm mounted door closers and push side mounted door stops/holders.

.6 Counter sink through bolt of door pull under push plate during installation.

.7 Mount all closers, and hold-open devices with through bolts, as indicated in the finish hardware schedule.

.8 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.9 Other trades installing hardware must follow all manufacturer's instructions including door closer adjustment, handing of locksets as required, and degree of door swing.

.10 Hardware Distributor will instruct the installer as to how various newer or unusual items that are required to be installed for proper performance.

3.3 FIELD QUALITY CONTROL

.1 Hardware distributer to perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.

.2 Upon completion of hardware installation, arrange with the Owner and Consultant demonstration and training in the proper operation, adjustment, and maintenance of all finish hardware supplied under this Contract.

.3 Before completion of the Work but after finish hardware installation has been completed, submit a certificate to the Consultant stating that final inspection has been made and that all hardware has been checked for installation and operation by representatives of both the Hardware Supplier and the Hardware Distributor, and that operation and maintenance of all hardware has been fully demonstrated to the satisfaction of the Owner, and verified by Consultant.

3.4 ADJUSTING AND CLEANING

.1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.

.2 All hardware to be left clean and free of disfigurements.

.3 Check all locked doors against approved keying schedule.

3.5 PROTECTION

.1 Protect hardware from damage during construction period by removing and reinstalling or where necessary, using temporary hardware to maintain finish in new condition and maintain manufacturer’s warranty.

3.6 HARDWARE SCHEDULE

.1 Door D1

.1 3 Hinges - 5BB1HW 114 x 114 x 630

.2 1 Passage Set - L9010 x 07B x 630

.3 1 Door Closer - 4040 XP x 689

.4 1 Overhead Stop - 100S x 630

.5 1 Kickplate - 8400 x 305 x 40mm less door width x 630

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of glazing films.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM D1004-09, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting

.2 ASTM D3330/D3330M-04 (2010), Standard Test Method for Peel Adhesion of Pressure-Sensitive Tape

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate the Work of this Section with the installation of glazing; sequence work so that installation of glazing films coincides with installation of glass materials without causing delay to the Work.

1.5 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Verification Samples: Submit 300 mm x 300 mm sample of each type of film to the Consultant.

1.6 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit manufacturer’s written instructions for cleaning solutions, materials and procedures, include name of original installer and contact information.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Installer: Use installers having experience with projects of similar extent and complexity and that have experience laminating film to glass on site for a minimum of five (5) years.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver and store packaged materials in their original containers with manufacturer's labels and seals intact; store as recommended by manufacturer in a weatherproof enclosure.

1.9 SITE CONDITIONS

.1 Ambient Conditions: Proceed with film installation when ambient and substrate temperature conditions are within limits permitted by manufacturer and when glass substrates are free from wetness arising from frost, condensation, or other causes detrimental to adhesion.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include the following:

.1 Avery Dennison Graphics

.2 Llumar Window Film

.3 3M Window Film Solutions

2.2 GLAZING FILMS

.1 Translucent Glazing Film: Single layer decorative cast film with pressure sensitive ultraviolet resistant adhesive and scratch resistant coating; computer generated and cut and as follows:

.1 Dusted Crystal Matte by Avery Dennison Graphics

.2 Matt Frost Film by Llumar Window Film

.3 Fasara Matte Crystal by 3M Canada

3 Execution

3.1 EXAMINATION

.1 Examine glass and surrounding adjacent surfaces for conditions affecting installation; proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

3.2 PREPARATION

.1 Prepare glazing films using computer generated CNC cutting methods to eliminate any cutting of films directly on glass at project site.

.2 Clean glass surfaces of substances that could impair glazing film bond including mould, mildew, oil, grease, dirt and other foreign materials immediately before beginning installation of films.

.3 Protect window frames and surrounding conditions from damage during installation.

3.3 INSTALLATION

.1 Install in accordance with the manufacturer's written instructions and the contract documents, plumb, true, and level over clean glazing.

.2 Install film continuously, but not necessarily in one continuous length, with no gaps or overlaps and as follows:

.1 Install seams vertical and plumb where necessary; horizontal seams will not be allowed.

.2 Do not remove release liner from film until just before each piece of film is cut and ready for installation.

.3 Install film with mounting solution and custom cut to the glass with neat, square comers and edges to within 3 mm of window frame.

.4 Remove air bubbles, wrinkles, blisters, and other defects.

.3 Installation Tolerances: Consultant will view film installation from a distance of 3 metres against a bright uniform sky or background and will accept installation where it appears uniform in appearance with no visible streaks, banding, thin spots or pinholes; remove and replace with new film when directed by the Consultant for materials not meeting requirements.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 The work in this section includes supply and installation for the following:

.2 Tiling and bonding systems for floor and wall tile including:

.1 Porcelain (PCT)

.3 Waterproof membrane

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C1028, Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-75.1-M88, Tile, Ceramic

.4 Terrazzo, Tile and Marble Association of Canada (TTMAC):

.1 2019-2021 Specifications Guide 09 30 00, Tile Installation Manual

.2 Hard Surface Maintenance Guide

1.4 PERFORMANCE REQUIREMENTS

.1 Tile products manufactured and tested to ISO 10545 Series and ANSI A137.1.

.2 Slip Resistance: Minimum dynamic coefficient of friction (DCOF) of 0.42 wet to ANSI A137.1.

.3 Floor Traffic Load Bearing Performance: As specified in this section and the TTMAC Guide Specification.

.4 Surface Flatness Tolerances:

.1 Small Format Floor Tile less than 100 x 100 mm: Floor flatness as specified in Section 03 35 00 – Concrete Finishing.

.2 Standard Format Floor Tile 100 x 100 mm to 400 x 400 mm: Floor flatness measured to a minimum FF35; equivalent to 5 mm with maximum 2 gaps under a 3 m straightedge measurement.

.3 Large Format Floor Tile 400 x 400 mm: Floor flatness measured to a minimum of FF50; equivalent to 3 mm with maximum 2 gaps under 3 m straightedge measurement.

.4 Wall Tiles: Wall levelling similar to floors tiles having similar sizes listed above.

1.5 SUBMITTALS FOR REVIEW

.1 Product Data: For each product. Include installation instructions for using setting materials and grouts.

.2 Samples:

.1 Submit sample panel of each type and colour tile, 610 mm x 610 mm (24" x 24"). Adhere to a rigid board with setting compound, grout and a dummy control joint showing sealant as specified. Identify samples by project number, date, name of sub-contractor and tile

type. Tile and grout used in the building shall correspond to appearance of approved samples in all respects. Do not install tile until samples are approved.

.2 Upon Consultant's request submit samples of base, trim and fittings.

1.6 SUBMITTALS FOR INFORMATION

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

.2 Tile setting material manufacturer's review report.

.3 Field test reports.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.8 QUALITY ASSURANCE

.1 Perform work in accordance with TTMAC Specification Guide, Tile Installation Manual.

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

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

.4 Tile Setting Material Manufacturer's Review:

.1 Prior submitting Submittals obtain tile setting manufacturer’s review and approval for conformance of tile installation methods and procedures with warranty requirements.

.2 Prepare and submit report signed by the tile setting manufacturer.

.3 Review of waterproofing membrane installation, and provide required testing ensuring waterproofing membrane manufactures recommended thickness is achieve.

1.9 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Co-ordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Restrict traffic by other trades during installation.

.5 Provide adequate protection of completed tiled surfaces to prevent damage by other trades until final completion of this project. Minimum protection shall consist of 4 mil polyethylene sheets lapped minimum 100 mm (4") and taped.

.6 Heavily travelled areas shall have additional 13 mm (1/2") thick fibreboard sheet protection with taped joints over polyethylene sheet protection as specified above.

.7 Protect exposed edges of floor tile with same thickness as tile x 102 mm (4") wide tapered strip of plywood adhered to floor until adjoining floor finish is to be installed.

1.10 SITE CONDITIONS

.1 Ambient Conditions: Apply tile after completion of work by other Sections is complete; to surfaces sufficiently dry, clean, firm, level, plumb and free from oil or wax or any other material deleterious to tile adhesion and as follows:

.1 Temperature: Maintain tile materials and substrate temperature between TTMAC recommended minimum and maximum temperature range; unless indicated otherwise by manufacturer, for 48 hours before and during installation until materials are fully set and

cured; provide additional heat during winter months or at any other time when there is a risk that surface temperatures may drop below minimum recommended temperatures.

.2 Ventilation: Maintain adequate ventilation where Work of this Section generates toxic gases or where there is a risk of raising relative humidity to levels that could damage building finishes and assemblies.

1.11 WARRANTY

.1 Warrant the work of this Section against defects in materials and workmanship in accordance with the General Conditions, but for a period of five (5) years from date of Substantial Performance, and agree to promptly make good defects which become evident during the warranty period without cost to the Owner. Defects shall include but not be limited to the following; cracking, crazing, discolouration, staining, pitting, splitting and deformation of tiles and grout.

2 Products

2.1 MATERIALS – PORCELAIN TILE (PCT)

.1 ANSI 137.1; cushion edges; colour through rectified porcelain tiles.

.2 Slip Resistance: Required.

.3 Floor Tile: Spazio by Stone Tile.

.1 Size: 300mm x 300mm.

.2 Colour: Perla, matte finish.

.4 Wall Base Tile: Spazio by Stone Tile.

.1 Size: 300mm x 300mm, cut to 100mm high as indicated.

.2 Colour: Antracite, matte finish.

.5 Wall Tile: Spazio by Stone Tile.

.1 Size: 300mm x 300mm.

.2 Colour: Beige, matte finish.

.6 Shower Stall Tile: Spazio by Stone Tile

.1 Colour: Listelli C mosaic sheet.

2.2 MORTAR AND GROUT MATERIALS – GENERAL

.1 Acceptable Tile Setting Materials: Subject to conformance to requirements, mortar and grout materials listed below shall be of a uniform quality for each adhesive, and grout component from a single manufacturer and each aggregate from one source or producer as follows:

.1 Laticrete International Inc.,

.2 Mapei Corporation,

.3 TEC Incorporated Building Products Group, an H.B. Fuller Company,

.4 Flextile Ltd.

.2 Setting and Grouting Materials: Conform to material standards in ANSI's Specifications for the Installation of that apply to materials and methods specified.

.1 Grout Colours: Unless otherwise indicated, to be selected by Consultant.

.2 Grout joints: for stone floor tiles provide grout material capable of maintaining maximum 3 mm grout joints.

.3 Source limitations: All materials shall be from one manufacturer, forming a complete system.

.4 Products: Provide like products from same production run. Install products in sequence from sequentially numbered dye lots.

2.3 MORTAR AND GROUT SETTING SYSTEMS

.1 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:

.1 Thinset Mortar:

.1 4237 latex additive and 211 Crete filler powder by Laticrete,

.2 Kerabond with Keralastic by Mapei ,

.3 TA 382 Ultimate LFT by TEC, HB Fuller.

.4 '51 Premium Wall & Floor Thin-Set Mortar with 44 Acrylic Additive' by Flextile.

.2 Trowelable Underlayment and screed Compound:

.1 226/3701 mortar mix by Laticrete,

.2 Topcem by Mapei, or

.3 TA 305 Fast Set Deep Patch by TEC, HB Fuller.

.4 FAST-SET SCREED BY Flextile

.3 Grout: ANSI A108/A118/A136.1:

.1 Standard for dry locations:

.1 SPECTRALOCK PRO Premium Grout by Laticrete, or

.2 Mapei UltracolorPlus, or

.3 PowerGrout by TEC, HB Fuller or

.4 1600 RSG by Flextile

2.4 TILE SETTING SYSTEMS FOR WET AREAS

.1 Materials General: to ANSI A108/A118/A136.1 and TTMAC Detail indicated:

.1 Scratch/Skim/ Bond Coat:

.1 211/4237 by Laticrete,

.2 Kerabond mixed with Keralastic additive by Mapei,

.3 TA392/393 SUPERFLEX ULTRA PREMIUM THIN SET by TEC

.4 #51 FLOOR & WALL PREMIUM MORTAR MIXED #44 ACRYLIC ADDITIVE by Flextile

.2 Mortar Bed/levelling coat: For bed thicknesses over 40 mm, suspend reinforcing mesh within mortar bed.

.1 226/3701 mortar mix by Laticrete,

.2 Topcem with Planicrete AC by Mapei,

.3 TA305 FAST SET DEEP PATCH WITH PATCH ADDITIVE by TEC,

.4 FAST-SET SCREED or 4:1 DRY PACK with #44 Acrylic Additive by Flextile

.3 Waterproof Membrane: ANSI A118.10

.1 Hydroban by Laticrete

.2 Aquadefense by Mapei

.3 TA 316 Hydraflex by TEC, HB Fuller

.4 WP-900 HYDRO-BLOCK by Flextile

.4 Grout: ANSI A108/A118/A136.1 Epoxy Grout:

.1 SPECTRALOCK PRO Premium Grout by Laticrete

.2 Kerapoxy by Mapei

.3 AccuColour EFX by TEC, HB Fuller

.4 FLEX-EPOXY 100 GROUT by Flextile

.5 Fibreglass reinforcing mesh and cleavage membrane, as recommended by manufacture.

2.5 ACCESSORIES

.1 Water: Fresh, clean, potable, free from deleterious matter, acids or alkalis.

.2 Sealant: movement and joint sealants as specified in Section 07 92 00 –Sealants.

.3 Trims:

.1 Transition Edge Strips: Extruded mill finished clear satin anodized aluminum edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material and sloped profile transition

.1 Basis-of-Design Materials: Schlüter Reno Ramp Series.

.4 Provide fillers, primers, reinforcing fabric and all other materials and accessories as recommended by the crack suppression membrane manufacturer.

.5 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:

.1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturer’s recommendations and as recommended by tile manufacturer.

.2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer’s recommendations.

2.6 MORTAR AND GROUT MIXING

.1 Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

.2 Add materials, water, and additives in accurate proportions.

.3 Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated or specified.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work.

.1 Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated or specified.

.2 Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

.3 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Consultant.

.3 Verify sealants and grout are cured for manufactured recommended periods at required temperatures and relative humidity conditions, before water immersion.

.4 Commencement of installation shall signify complete acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Surface Preparation:

.1 Make backing surfaces level and true to a tolerance in plane of ± 3 mm in 2 m (1/8" in 8') for walls and ± 3 mm in 3 mm (1/8" in 10') for floors using levelling bed mortar.

.2 Surfaces shall be structurally sound, well fastened, clean and free from dust, oil, grease, paint, tar, wax, curing agents, primers, sealers, form release agents or any deleterious substances that may act as bond barriers.

.3 Backing surfaces shall be dry and fully cured. Dampness must not exceed 5% by volume.

.2 Examine concrete substrate, repair as required to produce level, clean surface for new tile installation. Repair Work shall include levelling, filling, grinding or cutting, in accordance with Section 03 35 00 – Concrete Finishing.

.3 Work of other trades that are required before new tile installation (i.e. electrical conduit installed below ceramic tile) shall be installed, complete and approved before tile installation.

.4 Fill cracks, holes, and depressions in concrete substrates for tiling installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

.5 Check as per ASTM F710 for Concrete Preparation for excessive moisture levels & pH of the slab.

3.3 INSTALLATION - GENERAL

.1 Installation of the tile shall be by thin-set method, as indicated on the drawings and as specified herein;

.1 Install wall tile to gypsum wallboard and moisture resistant wallboard in dry areas using latex modified thin-set setting bed and latex modified wall grout in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.

.2 Apply floor tile and prepare floor slabs in strict accordance with tile manufacturers written installation instructions as per the pre-installation conference.

.2 Install mortar bed, tile, and grout to referenced TTMAC Manual and TTMAC systems listed.

.3 Thoroughly clean surfaces to which tile is to be applied.

.4 Back butter all floor tile.

.5 Neatly cut tile around fitments, fixtures, access panels, and the like. Splitting of tile is expressly prohibited except where no alternative is possible. Form intersections, corners and returns accurately.

.6 Finish surfaces flat and level or, sloped and graded as required.

.7 Joint Widths: Install tile with the following joint widths, unless indicated on drawings:

.1 Wall Tile: 2 mm (1/16")

.2 Floor Tile: 6 mm (1/4"), unless otherwise indicated on the Drawings.

.3 Make joints consistent width and alignment within tile area.

.4 Maintain 2/3 of grout joint depth free of setting material.

.8 Joints in base shall match floor patterns. Joints shall be watertight without voids, cracks or excess grout.

.9 Lay out tile so that fields or patterns are centred on wall areas or architectural features and so that no tile less than 1/2 size occurs.

.10 Arrange and set recessed accessories in tile work so that they are evenly spaced, centred with joints and set true with correct projection. Rigidly install accessories.

.11 Provide manufacturer's standard trim pieces at changes of direction and at terminations. Unless otherwise indicated provide the following corner and edge conditions:

.1 Internal horizontal corners: Coved.

.2 External vertical and horizontal corners: Bullnosed.

.3 Internal vertical corners and unexposed edges: Square.

.12 Install tiles in patterns and locations as indicated on drawings.

.13 Install wall tile full wall height unless shown otherwise.

.14 Coordinate work of this Section with work of other Sections for items requiring to be recessed into work of this Section.

.15 Sound tiles after setting and remove and replace tiles not fully bedded.

.16 Re-point joints after cleaning to eliminate imperfections. Avoid scratching tile surfaces.

.17 Finished tile work shall be clean and free of tiles which are pitted, chipped, cracked or scratched. All damaged tile shall be removed and replaced.

.18 Where indicated on Drawings or as required, install continuous single piece metal edge trims centred under doors in closed position and other locations where tile meets other floor finishes.

.19 Allow tile to set for a minimum of 48 hours prior to grouting.

3.4 GROUTING

.1 Grout tiles in accordance with ANSI A108.10 and as specified herein.

.2 When grouting a fresh laid floor, make certain that traffic and grouting will not cause movement of floor in setting bed. Protect floor by using kneeling boards or gypsum board to defend floor against traffic while grouting.

.3 Mix grouts and install in strict accordance with the manufacturer's instructions.

.4 Excess grout shall be removed from the surface of tiles using the edge of a rubber float held at a 45 deg angle, moving it diagonally to the joints. Fill all gaps and air holes.

.5 Do not allow grout to harden on face of tile. Refer to manufacturer's instructions for thorough removal.

.6 Floors which required damp curing shall be cured for the required length of time using heavy kraft paper, not polyethylene sheets. Consult manufacturer for instructions.

3.5 CONTROL JOINTS AND SEALING

.1 Control joints of a flexible caulking material shall be placed every 4877mm to 6096mm (16 to 20') apart, directly over existing control joints and/or where indicated on drawings or as required in accordance with TTMAC Detail No. 301MJ-2019-2021, Details E, F and G, whichever is applicable. Control joints shall be placed around the floor perimeter at walls, around columns, and where tile abuts other hard materials or vertical surfaces. Saw cutting of tile after installation is prohibited. Tile shall be cut if required and installed along each side of control joints.

.2 Expansion joints must always be placed directly over all slab expansion joints in accordance with TTMAC Detail No. 301MJ-2019-2021, Details A and B, whichever is applicable.

.3 Locate expansion, control, contraction, and isolation joints, as indicated below, unless specifically indicated otherwise on the Drawings:

.1 Interior: 5 m (16') maximum: 6 mm (1/4") joint width.

.2 Exterior: 4 m (12') maximum: 9.5 mm (3/8") joint width.

.4 Joints around fixtures, pipes or other fittings shall be sealed with a sealant. Refer to Section 07 92 00 – Sealants for type of sealants to be used.

.1 Colour of sealant shall match grout as selected later by Consultant.

3.6 WATERPROOFING

.1 Install waterproofing in accordance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

3.7 DO NOT INSTALL TILE OVER WATERPROOFING UNTIL WATERPROOFING HAS CURED AND BEEN TESTED TO DETERMINE THAT IT IS WATERTIGHT.CLEANING AND FINISHING

.1 Clean tiled areas after grouting has cured, using compatible solutions and methods as recommended by the manufacturer.

.2 Remove grout residue from tile as soon as possible.

.3 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation.

.4 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.5 Flush surface with clean water before and after cleaning.

.6 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

3.8 PROTECTION OF FINISHED WORK

.1 Protect installed work.

.2 Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of:

.1 Acoustical panel ceiling systems (ACT).

.2 Suspended metal grid ceiling system and perimeter trim.

.3 Supplementary acoustic insulation over system units.

.4 Site quality control.

1.3 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C635/C635M, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

.2 ASTM C636/C636M, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

.3 ASTM E1264 Standard Classification for Acoustical Ceiling Products

.3 Underwriters Laboratories of Canada (ULC):

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

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Suspension System:

.1 Determine the superimposed loads that will be applied to suspension systems by components of the building other than the ceiling and ensure that adequate hangers are installed to support the additional loads in conjunction with the normal loads of the system.

.2 Design supplemental suspension members and hangers where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at required spacing to support standard suspension system members:

.3 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

.4 Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of L/360.

.5 Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to applicable code.

.6 Surface-Burning Characteristics: Conform to CAN/ULC S102 or ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate layout and installation of ceilings with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression system.

1.6 SUBMITTALS FOR REVIEW

.1 Submit submittals in accordance with the General Conditions and Section 01 33 00 – Submittal Procedures.

.2 Product Data: Submit product data for each type of product specified.

.3 Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling mounted items indicating the following:

.1 Ceiling suspension system members.

.2 Method of attaching suspension system hangers to building structure.

.3 Ceiling mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special mouldings at walls, column penetrations, and other junctures of acoustic ceilings with adjoining construction.

.4 Samples:

.1 Submit two 300 x 300 mm samples illustrating material and finish of each type of acoustic unit.

.2 Submit two 300 mm long samples of suspension system main runner, cross runner, and perimeter moulding.

1.7 SUBMITTALS FOR INFORMATION

.1 Qualifications Data: For Installer.

.2 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.

.3 Professional Structural Engineer’s Letters of Assurance:

.1 Provide letters or completed Owner-prescribed forms signed by the professional structural engineer used to prepare the shop drawings, stating that the ceiling system has been designed accordance with the structural performance requirements of the applicable codes, including verification that:

.1 Specified products have been used.

.2 Designs and installations as tested, have been installed on the Project.

.3 Loads and movement requirements have been achieved.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Acoustical Ceiling Units: Full size units equal to three percent of quantity installed, of each tile type.

.2 Suspension-System Components: Quantity of each concealed grid and exposed component equal to three percent of quantity installed.

1.9 QUALITY ASSURANCE

.1 Conform to Ceilings and Interior Systems Contractors Association (CISCA) Ceiling Systems Handbook requirements.

.2 Qualifications of Installer: Approved by suspension system manufacturer.

1.10 REGULATORY REQUIREMENTS

.1 Conform to applicable code for combustibility requirements for materials.

.2 Conform to applicable code for seismic requirements for ceiling system.

1.11 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off-the-ground, under cover storage location. Do not load any area beyond the design limits.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store material in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

1.12 SITE CONDITIONS

.1 Ambient Conditions: Install acoustic unit ceilings only when building is enclosed, has sufficient heat, when overhead mechanical and electrical work is complete, and dust and moisture producing activities are complete; maintain uniform temperatures and relative humidity within range recommended by material manufacturer from the time of installation until Substantial Performance for the project; make adjustments to temperature and humidity gradually within tolerances indicated by manufacturer.

1.13 WARRANTIES

.1 Provide two (2) year warranty by manufacturer of acoustic panels covering defects in products and failure to meet specified requirements.

2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include the following:

.1 Armstrong World Industries Canada Ltd,

.2 CertainTeed Gypsum Canada Inc. a Division of Saint-Gobain, or

.3 CGC Inc. a USG Company.

.4 Rockfon LLC.

2.2 METAL SUSPENSION SYSTEMS

.1 Grid Components: ASTM C635/C635M, intermediate duty; exposed, downward access removable T; components die cut and interlocking; minimum 38 mm high bulb tee design.

.1 Recycled Content: minimum 50 %

.2 Grid Materials: Hot dip galvanized steel with factory paint finishes.

.3 Grid Finish: White, manufacturer’s standard.

.4 Module: Sized as appropriate to acoustic panel size.

.5 Mouldings:

.1 Perimeter Moulding: Formed to provide shadow reveal profile moulds unless shown otherwise in baked white enamel finish.

.6 Exposed Suspension System (Type 1): Provide standard exposed 'T' bar system: zinc-coated steel with baked white enamel finish for 25 mm exposed surfaces in colour to match acoustic panels.

.1 Acceptable Products:

.1 Prelude XL HRC manufactured by Armstrong World Industries Canada Ltd.

.2 15/16” Classic Stab System’ by CertainTeed Gypsum Canada.

.3 DONN Brand Suspension System DX/DXL HRC by CGC Inc.

.4 Chicago Metallic 1200HRCMax 15/16” Stab System by Rockfon LLC.

2.3 ACOUSTIC CEILING PANELS (ACT)

.1 Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by the nominal values for types, patterns, acoustic ratings, and light reflectance class, unless otherwise indicated.

.2 Surface burning properties, all types: Flame spread of 25 or less and smoke developed of 50 or less when tested in accordance with CAN/ULC S102, substantiated by ULC labels on materials supplied.

.3 Acoustic Panel (ACT): ASTM E1264, Type XII, Form II, Pattern G:

.1 Performance:

.1 NRC: Min. 0.70.

.2 Thickness: 19 mm.

.3 Surface Texture: Fine.

.4 Surface Colour: White.

.2 Edge Profile: Square.

.3 Sizes: 610 x 1220 mm.

.4 Approved Products:

.1 ULTIMA SQ Lay-In series manufactured by Armstrong World Industries Canada Ltd.

.2 Symphony M series by CertainTeed Ceilings Canada,

.3 MARS ClimaPlus HRC 85/35 series manufactured by CGC Inc.,

.4 Artic by Rockfon LLC.

2.4 ACCESSORIES

.1 Accessories: Stabilizer bars, clips, perimeter mouldings and splices required for suspended grid system.

.2 Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

.3 Ties Wire: minimum 1.98 mm (14 ga.) Ø steel wire, galvanized.

.1 Hanger Attachments to Concrete: 1 #12 galvanized annealed steel wire for support of a maximum weight of 68 kg. per hanger; #9 galvanized annealed steel wire for support of a maximum weight of 140 kg. per hanger; 4.5 mm diameter galvanized annealed steel rod to support a maximum weight of 250 kg. per hanger.

.4 Anchors: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency; Minimum tensile strength 390 MPa.

.5 Acoustic Sealant for Perimeter Mouldings: As specified in Section 07 92 00 – Sealants.

.6 Edge Trim:

.1 Axiom Classic Trim by Armstrong World Industries Canada Ltd. or equivalent by a listed suspension system manufacturer.

.1 Height: 50 mm and 102 mm high as indicated.

.2 Colour: White.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION – GENERAL

.1 Install acoustical ceilings according to CISCA publication Ceiling Systems Handbook.

3.3 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

.1 Install suspension system to manufacturer instructions and ASTM C636/C636M, and as supplemented in this section.

.2 Install system in accordance with ASTM E580/E580M.

.3 Install system capable of supporting imposed loads to a deflection of L/360 maximum.

.4 Lay out system to a balanced grid design with edge units no less than 50 percent of acoustic unit size, unless otherwise detailed.

.5 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

.6 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.

.7 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

.8 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 150 mm of each corner; or support components independently.

.9 Do not eccentrically load system, or produce rotation of runners.

.10 Perimeter Moulding:

.1 Install edge moulding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.

.2 Use longest practical lengths.

.3 Overlap corners.

.4 Provide at junctions with other interruptions.

3.4 INSTALLATION - ACOUSTIC UNITS

.1 Install acoustic units to manufacturer's instructions.

.2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

.3 Install units after above ceiling work is complete.

.4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.5 Cutting Acoustic Units:

.1 Cut to fit irregular grid and perimeter edge trim.

.6 Where round obstructions occur, provide preformed closures to match perimeter moulding.

.7 Where indicated, lay acoustic insulation for a distance of 1 200 mm either side of acoustic partitions.

.8 Install panel hold-down clips, where specified, to retain panels tight to grid system.

3.5 ERECTION TOLERANCES

.1 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.

.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 SITE QUALITY CONTROL

.1 Engage a professional structural engineer experienced in design and installation of this work and licensed in the Province where the Project is located to:

.1 Perform timely and regular inspections.

.2 Verify installation conforms to applicable code.

.3 Prepare and submit inspection reports.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Provide labour, materials, tools and other equipment, services and supervision required to complete interior and exterior, including above roof, painting and decorating work.

.2 Surface preparation for this section will be limited to priming and back-priming, and specific pre-treatments noted in this section or as specified in the Master Painters Institute (MPI) Painting Specification Manual.

1.3 RELATED REQUIREMENTS

.1 Other sections of the specification requiring painting refer to this section. Coordinate requirements of referencing sections.

1.4 REFERENCE STANDARDS

.1 All references standards specified herein imply the latest edition of the standards.

.2 Environmental Choice Paints and Surface Coatings, Low VOC Product Listings Program (ECP):

.1 Paints and Surface Coatings, Low VOC Product Listings

.3 The Master Painters Institute (MPI):

.1 New and Existing Surfaces: Architectural Painting Specification Manual.

.4 The Society for Protective Coatings (SSPC):

.1 Coating Materials Guidelines

.2 Surface Preparation Guidelines

.3 Application, Inspection and Quality Control Guidelines

1.5 DEFINITIONS

.1 Gloss Levels: Standard coating terms defined by MPI Manual apply to products of this Section as follows:

.1 G1: Matte of Flat: Lustreless or matte finish with a gloss range below 10 when measured at 85° to meter and 0 to 5 when measured at 60°.

.2 G2: Velvet: Matte to low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 0 to 10 when measured at 60°.

.3 G3: Eggshell: Low sheen finish with a gloss range of 10 to 35 when measured at 85° to meter and 10 to 25 when measured at 60°.

.4 G4: Satin: Low to medium sheen with a gloss range of minimum 35 when measured at 85° to meter and 20 to 35 when measured at 60°.

.5 G5: Semi-Gloss: Medium sheen finish with a gloss range of 35 to 70 when measured at 60° to meter.

.6 G6: Gloss: High sheen finish with a gloss range of 70 to 85 when measured at 60° to meter.

.7 G7: High Gloss: Reflective sheen having a gloss range in excess of 85 when measured at 60° to meter.

1.6 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting any work of this Section:

.1 Product Data: Submit list of all painting materials used for the Work to the Consultant for review prior to ordering materials for each paint system indicated, including block fillers and primers.

.1 Material List: An inclusive list of required coating materials indicating each material and cross reference specific coating, finish system, and application; identify each material by manufacturer's catalogue number and general classification.

.2 Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

.2 Samples: Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application, and as follows:

.1 Drawdown Samples: Provide three (3) drawdown sample charts (cards) for each type, texture and colour of finish specified for verification purposes before ordering paint materials.

.3 Informational Submittals: Provide the following submittals when requested by the Consultant:

.1 Certification: Submit certification reports for paint products indicating that they meet or exceed low VOC and coloured base requirements listed in this Section.

1.7 PROJECT CLOSEOUT SUBMISSIONS

.1 Operation and Maintenance Data: Submit copies of paint manufacturer’s written maintenance information for inclusion in the operations manual in accordance with Section 01 33 00 – Submittal Procedures, including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

.2 Maintenance Materials: Deliver maintenance materials to Owner in quantities indicated and in accordance with Section 01 33 00 – Submittal Procedures, that match products installed; packaged with protective covering for storage, and identified with labels describing contents and building location and as follows:

.1 Paints and Coatings: Minimum of 4-4L containers of field colours and 4-1 L containers of each accent colour, and all remnants.

1.8 QUALITY ASSURANCE

.1 Conform to the standards contained in the MPI Manual.

.2 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in service performance, and as follows:

.1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.

.2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.

.3 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:

.1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Conform to MPI Manual and manufacturers requirements.

.2 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.

.3 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.

.4 Ensure adequate continuous ventilation and sufficient heating and lighting is in place.

.5 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.

.6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground retain cleaning water and filter out and properly dispose of sediments.

.7 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.10 WARRANTY

.1 Special Warranty: Provide an MPI two (2) year guaranty, or a 100% two (2) year Maintenance Bond in accordance with MPI Manual requirements; painting subcontractors choosing the Maintenance Bond option must provide a maintenance bond consent from a reputable surety company licensed to do business in Canada as follows:

.1 Warrant that painting work has been performed in accordance with MPI Manual requirements.

.2 Provide a cash value to repair or replace defective coatings in the event that the original installer is not able to perform warranty work.

2 Products

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers that have attained the prerequisites for ecologically sustainable labelling mark on their products and may be incorporated into the Work include; but are not limited to, the following:

.1 Sherwin-Williams LLC

.2 Benjamin Moore and Co. Limited

.3 ICI Paints (Canada) Inc.

.4 Para Paints

.5 PPG Canada Inc.- Architectural Finishes

.6 SICO Inc.

2.2 MATERIALS

.1 Primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, and other painting materials shall be in accordance with the MPI Manual “Approved Product” listing and shall be from a single manufacturer for each system used.

.2 Materials such as linseed oil, shellac, and other accessory materials shall be the highest quality product of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials.

.3 All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

.4 Colour and Manufacturer: To be selected by Consultant.

3 Execution

3.1 PREPARATION OF SURFACES:

.1 Prepare surfaces in accordance with MPI Manual requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

.1 Protect adjacent surfaces from sanding, so not to cause damage to those surfaces.

3.2 APPLICATION

.1 Paint when substrates and environmental conditions (heating, ventilation, lighting and completion of other work) are acceptable for applications of products specified in this Section.

.2 Paint surfaces requiring paint or stain finish to Premium MPI Manual finish requirements with application methods in accordance with best trade practices for type and application of materials used.

.3 Continue paint finishes through behind wall mounted items.

.4 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.

.5 Apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

3.3 INTERIOR SURFACES

.1 Paint interior surfaces in accordance with the MPI Manual painting systems listed in this section.

.2 Concrete Horizontal Surfaces (floors and stairs):

.1 INT 3.2F: Concrete floor sealer, solvent based.

.3 Concrete Masonry Units (smooth and split face block and brick):

.1 INT 4.2D: High Performance Architectural Latex semi gloss coating.

.4 Galvanized Metal (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etcetera):

.1 INT 5.3M: High performance architectural latex semi gloss finish.

.5 Dressed Lumber (including doors, door and window frames, casings, mouldings, etcetera):

.1 INT 6.3A: High Performance Architectural Latex semi-gloss finish.

3.4 MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Paint "unfinished" conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:

.1 In exposed-to-view exterior and interior areas.

.2 In interior high humidity interior areas.

.3 In boiler room, mechanical and electrical rooms.

.2 Leave conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks in unfinished areas.

.3 Paint inside of ductwork where visible behind louvers, grilles and diffusers beyond sight line with primer and one coat of matt black (non-reflecting) paint.

.4 Paint the inside of light valances gloss white.

.5 Refer to Mechanical and Electrical specifications for painting, banding, stencilling of other surfaces/equipment, and generally as follows:

.1 Paint gas piping gas standard yellow where visible in service spaces.

.2 Paint both sides and all edges of plywood backboards for equipment before installation.

.3 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.4 Do not paint over nameplates.

3.5 SITE QUALITY CONTROL

.1 Painted surfaces will be considered to lack uniformity and soundness if any of the following defects are apparent at time of field review when viewed from a distance of 4’ from the painted surface:

.1 Runs, sags, hiding or shadowing by inefficient application methods

.2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles

.2 Painted surfaces will be considered as deficient if any of the following defects are apparent at time of field review, regardless of viewing distance.

.1 Damage due to touching before paint is sufficiently dry or any other contributory cause.

.2 Damage due to application on moist surfaces or caused by inadequate protection from the weather.

.3 Damage or contamination of paint due to windblown contaminants (dust, sand blast materials, salt spray, etcetera)

.3 Painted surfaces found as unacceptable shall be replaced or repaired at no cost to the Owner or Consultant:

.1 Small affected areas may be touched up

.2 Large affected areas or areas without sufficient dry film thickness of paint shall be repainted.

.3 Runs, sags or damaged paint shall be removed by scraper or by sanding before application of new paint coats.

3.6 PROTECTION

.1 Protect newly painted exterior surfaces from rain and snow, condensation, contamination, dust, salt spray and freezing temperatures until paint coatings are completely dry.

.2 Curing periods shall exceed the manufacturers recommended minimum time requirements.

.3 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

3.7 CLEANUP

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of it in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water or solvents, and other cleaning and protective materials (rags, drop cloths, masking papers, etcetera), paints, thinners, paint removers and strippers in accordance with the safety requirements of authorities having jurisdiction.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

.2 All references standards specified herein imply the latest edition of the standards.

1.2 SUMMARY

.1 Furnish all labour and materials necessary for the completion of work in this Section as shown on the Contract Drawings and specified herein.

.2 Work in this Section includes but is not limited to:

.1 Solid Phenolic Toilet Partitions

.2 Solid Phenolic Urinal Screens

.3 Hardware

1.3 SUBMITTALS

.1 Product Data: For each product, indicate manufacturers and product name, including installation requirements and instructions.

.2 Shop Drawings:

.1 Submit shop drawings showing and describing in detail materials, finishes, dimensions, details of connections and fastenings elevations, plans, sections, thicknesses, hardware and any other pertinent information.

.3 Samples:

.1 Submit necessary templates and instructions where supports or anchors have to be built-in by others.

.2 Submit one sample of each of the following:

.1 Hinge, latch, panel fitting.

.2 300 mm x 300 mm corner section showing colour, corner, edge and core construction.

1.4 DELIVERY, STORAGE, HANDLING AND PROTECTION

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.

.2 Do not permit delivery of work to job site until building is sufficiently dry, wet trades are completed and the moisture readings of surfaces in proposed storage area is less than 18%.

.3 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Store materials flat on level surface. Protect materials with suitable non-staining waterproof coverings, but allow for air circulation at sides.

1.5 WARRANTY

.1 Warrant that the solid phenolic partitions and screens shall be free from defects in materials or workmanship in accordance with General Conditions for a period of ten (10) years and agree to promptly make good defects by replacing defective solid phenolic partitions and screens in finish to match original finish and in a manner satisfactory to Owner. Defects shall include, but not be limited to, bubbling, delamination of faces, or edges, warp, twist, bow exceeding 1/4" and telegraphing of core. "Replace" as used herein includes installing panels, pilasters, hardware, shoes including hanging and fitting doors.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design products are named in this Section; additional manufacturers offering similar solid phenolic toilet partition systems may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 Floor Anchored Toilet Partitions:

.1 Solid Phenolic DuraLine Series 1080 by Bobrick Washroom Equipment Inc.

.2 Phenolic Black Core Floor Anchored Toilet Compartments by ASI Global Partitions.

.2 Urinal Screens:

.1 1114mm (42") long x 610mm (24") wide wall hung type solid phenolic urinal screens with institutional hardware.

2.2 MATERIALS

.1 Solid Phenolic, Melamine Surfaced, Panels, Pilasters and Doors:

.1 Plastic Laminate Face Sheets: High pressure, paper based, melamine surfaced, laminated plastic sheets, conforming to CAN3-A172-M, with thickness tolerances in accordance with Table 1 of CAN3-A172-M and plastic laminate grades as follows:

.1 Cores: Solid phenolic type core material. Thicknesses as specified herein.

.2 Bituminous Paint: Acid and alkali resistant bituminous isolation coating.

.3 Butyl Tape: Extruded, High grade macro-polyisobutylene tape of width and shore hardness to suit conditions.

.4 Building Paper: No.15 asphalt saturated, organic felt in accordance with CSA A123.3.

.5 Hardware and Fittings (Institutional):

.1 Hinges: 1.6 mm thick (16 gauge) x 2" wide continuous stainless steel piano hinge with 1/8" diameter stainless steel pin and extends full height of doors.

.2 Door Latches: 2 mm thick (14 gauge) stainless steel type slide type on nylon track. Provide "C" type pulls at compartments for handicapped.

.3 Door Keepers: 2.9 mm thick (11 gauge) stainless steel type.

.4 Coat Hooks: Stainless steel type with rubber bumper on end.

.5 Door Stops: 2.9 mm thick (11 gauge) stainless steel type designed to prevent the door from being kicked out of compartment.

.6 'U' Channels: 1.2 mm thick (18 gauge) continuous 'U' shaped stainless steel channel extending full height of panels and screens.

.7 Hardware Material and Finish: Stainless steel shall be AISI 18-8 type 304 alloy conforming to ASTM A167.

.8 Hardware Fasteners: Vandal resistant, torks stainless steel machine screws installed from inside compartments. Door hardware shall also have factory installed threaded metal inserts in doors and pilasters.

.9 Provide reinforcement for washroom accessories as required to preserve integrity of partition panels and as required to ensure secure attachment of accessories.

.10 Top connection of pilaster for ceiling hung partitions shall consist of 3/4" diameter threaded rods complete with spacer and nuts and a 3" die-formed stainless steel pilaster

shoe. Stainless steel shall be 0.024" thick, AISI type 304 stainless steel alloy conforming to ASTM A167-92b.

.11 Install matching 19 mm (3/4") thick x 100 mm (4") wide overhead bracing between pilasters for reinforcing. Fasten with stainless steel plates and screws on the inside of each stall.

2.3 FINISHES

.1 Toilet Partition Panel Colours:

.1 Almond 4000 by ASI Global Partitions or approve alternate.

.2 Stainless Steel:

.1 AISI No.4 brushed finish.

2.4 FABRICATION AND MANUFACTURE

.1 Shop fabricate toilet partitions. Take site measurements for areas where partitions are to be located and fabricate to suit site dimensions.

.2 Fabricate doors, panels and pilasters from solid phenolic core material with high pressure matte plastic laminate surfaces fused to core. Edges shall be "black". Stiles and doors shall have a finished thickness of 3/4" thick. Panels shall be 1/2" thick.

.3 Check sizes and locations for washroom accessories and if necessary, reinforce panels.

.4 Prepare panels to accept tissue dispensers and grab bars where indicated on drawings.

.5 Design supports to withstand, within acceptable deflection limitations, their own weight, the weight of the toilet partitions, loads imposed by the motion of partition doors and all live loads, which might be applied to the toilet partitions in the course of their normal function. Design supports as required to accommodate structural deflection. Build in reinforcing to support the grab bars and withstand a downward pull of 500lbs. at any point on the grab bar. Provide additional stainless steel brackets as required to stabilize pilasters to consultant’s approval.

3 Execution

3.1 INSPECTION

.1 Check areas scheduled to receive partitions and urinal screens for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of holding brackets.

.2 Verify spacing of plumbing fixtures to assure compatibility with installation of partitions.

.3 Do not begin installation of partitions until conditions are satisfactory and agreement on details with the owners or contractors were well understood.

3.2 INSTALLATION

.1 Install partitions and urinal screens in strict accordance with manufacturer's installation recommendations.

.2 Install partitions and urinal screens plumb, level and securely fastened in the locations shown on the drawings.

.3 Perform drilling of steel, masonry and concrete necessary to install the work of this Section.

.4 Co-ordinate installation with the work of trades providing wall and floor finishes, washroom accessories and other adjacent partitions and constructions.

.5 Isolate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper, butyl tape or other approved means.

.6 Install hardware supplied under this Section and ensure that it is visually aligned.

.7 Securely install panels to walls and pilasters with fittings to make a strong and rigid installation.

.8 Locate wall channels so that holes for mounting occur in ceramic tile joints.

.9 Install urinal screens to locations on walls as indicated on drawings, plumb, level and rigidly secured in place.

.10 Install partitions allowing the following clearances and tolerances:

.1 Between panel edges and wall: 25 mm +3 mm (1" +1/8").

.2 Between partition panel edge and pilaster panel: 13 mm +3 mm (1/2" +1/8").

.3 Between pilaster panel edge and door edge: 5 mm +1.5 mm (3/16" +1/16"). Ensure that partitions are visually aligned from all view points.

3.3 ADJUSTMENT

.1 Upon completion of the work or when directed, remove all traces of protective coating or paper, and polish compartments.

.2 Test hinges, locks and latches and where necessary, adjust and lubricate. Set hinges so that doors stand open 30 deg when compartment is not in use. Ensure that compartments are in working order.

3.4 CLEANING

.1 Clean and make good surfaces soiled or otherwise damaged in connection with the work of this Section. Replacing finishes or materials that cannot be satisfactorily cleaned.

.2 Upon completion of the work, remove all debris, equipment and excess material resulting from the work of this Section from the site.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 Furnish labour, materials and other services to complete the fabrication and installation of washroom and custodial accessories including attachment hardware.

.2 Include all materials and fitments required for the operation of any unit furnished, in the manner, direction and performance shown on the shop drawings and specified herein.

1.3 REFERENCES

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware

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

.3 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.4 ASTM A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

1.4 SUBMITTALS

.1 Product Data: For each product, indicate manufacturers and product name, including installation requirements and instructions.

.2 Shop Drawings: Show and describe in detail, materials, finishes, dimensions, details of connections and fastenings, elevations, plans, sections, metal gauges, hardware and any other pertinent information.

.3 Coordinate the work of this Section with the placement of internal wall reinforcement.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for off the ground, under cover storage location.

.2 Materials shall be carefully checked, unloaded, stored and handled to prevent damage. Protect materials with suitable non-staining waterproof coverings.

.3 Store materials in original, undamaged containers or wrappings with manufacturer's seals and labels intact.

.4 Unsatisfactory materials shall be removed from the site.

.5 Adequately protect the structure and work of other Sections during delivery, storage, handling and execution of the work of the Section.

.6 Provide tools, plant and other equipment required for the proper execution of the work of this Section.

2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests for substitution.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 ASI Watrous - Global Partitions

.2 Bobrick

.3 Frost

.4 Koala Kare

.5 Dyson

2.2 MATERIALS

.1 Provide one of the products indicated for each designation in the Washroom and Custodial Accessory Schedule below, subject to compliance with specified requirements.

.2 Stainless Steel: In accordance with ASTM A666, Type 304, with No. 4 finish (satin); minimum nominal thickness as established by product type.

.3 Sheet Steel: Steel: In accordance with ASTM A1008/A1008M, cold rolled, commercial quality; minimum nominal thickness as established by product type; surface preparation and metal pretreatment as required for applied finish.

.4 Galvanized Steel Sheet: In accordance with ASTM A653/A653M, minimum Z180 coating designation.

.5 Galvanized Steel Mounting Devices: In accordance with ASTM A153/A153M, hot dip galvanized after fabrication.

.6 Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

.1 Washroom and Custodial Accessories:

.1 Surface Mounted:

.1 Fabricate units with tight seams and joints, and exposed edges rolled.

.2 Hang doors and access panels with continuous stainless steel hinge.

.3 Provide concealed anchorage where possible.

.2 Recessed Mounted:

.1 Fabricate units of all welded construction, without mitred corners.

.2 Hang doors and access panels with full length, stainless steel hinge.

.3 Provide anchorage that is fully concealed when unit is closed.

.2 Workmanship shall be best grade of modern shop practice known to recognized manufacturers specializing in this work. Joints and intersecting members shall be accurately fitted, made in true planes with adequate fastening. Wherever possible fastenings shall be concealed.

.3 Isolate where necessary to prevent electrolysis between dissimilar metal to metal or metal to masonry or concrete contact.

.4 Fabricate and erect work square, plumb, straight, true and accurately fitted. Provide adequate reinforcing and anchorage.

.5 Drilling shall be reamed and exposed edges left clean and smooth.

.6 Include anchors and fastenings necessary to anchor work of this Section.

.7 Coordinate with Section 06 10 00 – Rough Carpentry, for wood blocking for attachment of washroom accessories.

.8 Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six (6) keys to Owner's representative.

3 Execution

3.1 EXAMINATION

.1 Inspect surfaces over which the work of this Section is dependent for any irregularities detrimental to the application and performance of the work. Notify Consultant in writing of all conditions which are at variance with those in the Contract Documents and/or detrimental to the proper and timely installation of the work of this Section. The decision regarding corrective measures shall be obtained from the Consultant prior to proceeding with the affected work.

.2 Commencement of work of this Section implies acceptance of surfaces and conditions.

3.2 INSTALLATION

.1 Make thorough examination of drawings and details, determine the intent, extent, materials, conditions of interfacing with other work and be fully cognizant of requirements.

.2 Work of this Section shall include complete installation of items specified herein. Installation shall be in strict accordance with manufacturer's printed instructions.

.3 Securely fasten accessories, level and plumb in the locations shown on the drawings and specified herein. All fastenings shall be concealed.

.4 Co-ordinate the work of this Section with the work of other Sections to provide the necessary recesses, edge conditions wood blocking for the accessories as required.

.5 Do all drilling of steel, masonry and concrete necessary for the anchorage of the work.

.6 Installed grab bars shall be capable of supporting a downward pull of 500 lbs. per lineal foot.

3.3 ADJUSTING

.1 Check mechanisms, hinges, locks and latches, adjust and lubricate to ensure that accessories are in perfect working order.

3.4 CLEANING

.1 Upon completion of the work of this Section or when directed by Consultant, remove all protective coatings, and coverings. Clean and polish exposed surfaces.

3.5 WASHROOM AND CUSTODIAL ACCESSORY SCHEDULE

No.	Description / Model
CH1	Coat Hooks for Toilet Stalls: Satin finished stainless steel, square profiled robe hook with concealed mounting, provide 2 for each washroom, located as directed by Consultant: ASI 7340-S Bobrick B-76717
GB1	Grab Bar: 1.214mm (0.048") thickness; 610mm (24") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws: ASI 3801-24P Bobrick B-6806.99x24

No.	Description / Model
GB2	Grab Bar: 1.214mm (0.048") thickness; 765mm (30") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws: ASI 3801-30P Bobrick B-6806.99x30
GB3	Grab Bar: 1.214mm (0.048") thickness; 1067mm (42") long x 38mm (1-1/2") Ø, straight, stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws: ASI 3801-42P Bobrick B-6806.99x42
GB4	Grab Bar: Side "L"-shape grab bar, 760mm (30") long x 760mm (30") high 38mm (1-1/2") dia., stainless steel, slip resistant grip, concealed mounting, cap secured with vandal resistant set screws: ASI Type 04
PTDD	Paper Towel Dispenser and Disposal: Surface mounted, handicap accessible, capable of holding 600 C-fold or 800 multi-fold or 1100 single-fold paper towels, with leak proof waste container: ASI 64676-9 Bobrick B-380349 Frost 400C
MR1	Mirror (Tilt): Framed, 910mm (36") high x 460mm (18") wide, fixed tilt installation for barrier free access, mounted 1000mm (40") to bottom of frame: ASI 0535-1836 Bobrick B-293x1836
TPD	Toilet Tissue Dispenser: Double roll, surface mounted, tissue dispenser with concealed mounting, stainless steel construction, bright polished finish with theft resistant spindles: ASI 7305-2B-R009 Bobrick B-686-60
SD	Wall-Mounted Soap Dispenser: Heavy-duty all-purpose valve, wall-mounted stainless steel soap dispenser, 1.2L capacity with visible viewing window: ASI 0357 Bobrick B-818615
JS	Janitor's Shelf complete with Mop and Broom Holders and Hooks: 864mm (34") long x 330mm (13") high x 200mm (8") deep. Shelf constructed of minimum 18-8 stainless steel, type 304, 18 gauge. Utility hooks fabricated of 11 gauge stainless steel, and mop holders fabricated of cadmium plated steel. Pivoting, spring-loaded serrated rubber cam shall hold round handles of 22mm to 32mm (7/8" to 1-1/4") dia. ASI 1308-3 Bobrick B-239 x 34

No.	Description / Model
SHC	Shower Curtain: Opaque, matte white vinyl, 0.2mm (.008") thick, containing antibacterial and flame retardant agents. Complete with grommets every 150mm (6"), and hemmed top, bottom and sides. ASI 1200-V Bobrick 204-2
SHCH	Shower Curtain Hook: Fabricated of type 304 stainless steel alloy 18-8, solid formed wire 2.5mm (0.98") in diameter. Hook shall accommodate 25mm to 32mm (1" to 1-1/4") diameter curtain rods. ASI 1200-SHU Bobrick 204-1
SHCR	Shower Curtain Rod: Extra-heavy duty rod, 32mm (1-1/4") diameter fabricated of alloy 18-8 stainless steel, type 304, 18 gauge. Flanges fabricated from 20 gauge stainless steel. Satin Finish. Length: As determined on the Drawings. ASI 1204 Bobrick B-6047
SHSD	Shower Soap Dish: Type 304 stainless steel, matte polished finish. Mounting clamp for stud walls. Unit 7 3⁄16" W, 5" H (185 x 125mm). Rough Wall Opening: 6" W, 4" H, 4" min. depth (150 x 100 x 100mm). ASI 7404 Bobrick B-4380
SHS	Shower Seat: Constructed of durable, water-resistant, ivory colored, 5⁄16" (8mm) thick solid phenolic. Frame and mounting bracket are Type 304 stainless steel and self-locking mechanism. Supports up to 500 lbs (227 kg) when properly installed. Seat 22" (560mm) wide, projects 15 13⁄16" (400mm) from wall. ASI 8203 Bobrick B-5192

END OF SECTION

1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

.1 Basic mechanical materials, methods and requirements - Section 20 05 01.

.2 Wet-pipe Sprinkler Systems - Section 21 13 13

.3 Clean Agent Suppression Systems - Section 21 22 00.

1.2 SUBMITTALS

.1 **Shop Drawings:** Submit product data sheets, in shop drawings form, for all products specified in this Section.

2 Products

2.1 GENERAL

.1 All fire extinguishers are to be pressurized (stored pressure) rechargeable type, in accordance with NFPA 10, and ULC listed and labelled for the class of fires for which they are specified.

.2 Each extinguisher is to be complete with:

.1 A manufacturer's identification label indicating the extinguisher model number, rating, and operating instructions

.2 An anodized aluminum or chrome plated forged brass valve with positive squeeze grip on-off operation and a pull-pin safety lock

.3 Discharge hose with nozzle or horn and hose securing clip

.4 For wall mounted extinguishers, provide a wall mounting bracket

.3 Fire extinguishers in fire hose caninets will be supplied with the cabinet and are specified in the mechanical work Section entitled Fire Protection Standpipe System.

2.2 FE-1: HAZARD RATED WATER EXTINGUISHERS

.1 2A water extinguishers are to be 175 mm (7") diameter, 9.5 L (2 gal.) capacity, each complete with a polished stainless steel cylinder with tire valve for pressuring,waterproof stainless steel pressure gauge and wall hook/mounting bracket. Acceptable products are:

.1 National Fire Equipment Ltd. Strike First Model PWS250

.2 Wilson & Cousins Inc. Buckeye Fire Model PWS-25F

.3 Ansul Inc. Sentry Model W02-1

2.3 FE-2: ORDINARY HAZARD CARBON DIOXIDE EXTINGUISHERS

.1 10BC Carbon dioxide extinguishers are to be 170 mm (6 ¾") diameter, 6.8 kg (15 lb.), each complete with an aluminum cylinder with a safety red baked enamel finish. Acceptable products are:

.1 National Fire Equipment Ltd. Striker First 10lb, 10BC, Model CO2-100WW

.2 Wilson & Cousins Inc. Model CO2-10-W

.3 Ansul Sentry Model CD10A

2.4 FE-3: ORDINARY HAZARD DRY CHEMICAL EXTINGUISHERS

.1 3A10BC Multi-purpose dry chemical (monoammonium phosphate) extinguishers are to be 100 mm (4") diameter, 2.27 Kg (5 lb.) each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge. Acceptable products are:

.1 National Fire Equipment Ltd. Strike First 5lb, 3A10BC, Model ABC-050-WWD

.2 Wilson & Cousins Inc. Buckeye Fire 5lb, 3A40BC Model ABC-050-HW

.3 Ansul Inc. Sentry 5lb, 3A10BC, Model A05S

2.5 FE-3/FE-4: EXTRA HAZARD DRY CHEMICAL EXTINGUISHERS

.1 FE-3: 6A80BC Multi-purpose dry chemical (monoammonium phosphate) extinguishers are to be 133 mm (5-1/4") diameter, 4.54 kg (10 lb.) each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.

.2 FE-4: 10A120BC Multi-purpose dry chemical (monoammonium phosphate) extinguishers are to be 181 mm (7-1/8") diameter, 9.08 kg (20 lb.) each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.

.3 Acceptable products are:

.1 National Fire Equipment Ltd. Strike First 10lb, 6A80BC Model ABC-100WWD; Strike First 20lb, 10A120BC Model ABC-200WWD

.2 Wilson & Cousins Inc. Buckeye Fire 10lb, 4A80BC Model ABC-10G; Buckeye Fire 20lb, 20A120BC Model ABC-20G

.3 Ansul Inc. Sentry 10lb, 4A80BC Model AA10S; Sentry 20lb, 10A120BC Model AA20-1

2.6 FIRE EXTINGUISHER CABINETS

.1 **Surface Mounted:** Rectangular break-glass type, enclosure constructed of 1.2 mm (18 gge) corrosion resistant steel with a baked white enamel finish. All cabinets to come complete with front plexi glass panel with keyed alike cylinder lock that can be removed for servicing of the extinguisher. Also provide break-glass mechanism and instruction decal. Acceptable products are:

.1 5lbs, 216 mm x 506 mm x 160 mm, 3A10BC: National Fire Equipment Ltd. Model ECS-100; Wilson & Cousins Inc. Model FEC 05

.2 10lbs, 267 mm x 610 mm x 159 mm, 6A80BC: National Fire Equipment Ltd. Model ECS-999; Wilson & Cousins Inc. Model FEC 10

.3 20lbs, 362 mm x 768 mm x 229 mm, 10A120BC: National Fire Equipment Ltd. Model ECS-104; Wilson & Cousins Inc. Model FEC 20

.2 **Semi-Recessed:** Rectangular, cabinet with a 1.2 mm (18 gge) corrosion resistant white enamelled steel tub, 1.9 mm (14 gge) cleaned and prime coat painted steel door and adjustable trim assembly with rounded corners, semi-concealed piano hinge, safety glass panel, and flush stainless steel door latch. Acceptable products are:

.1 5lbs, 203 mm x 432 mm x 127 mm, 3A10BC: National Fire Equipment Ltd. Model 102RS; Wilson & Cousins Inc. Model FEC 05 complete with Front-FXC-05

.2 10lbs, 229 mm x 610 mm x 152 mm, 6A80BC/10BC: National Fire Equipment Ltd. Model CE-950-3-2; Wilson & Cousins Inc. Model IE100-R2

.3 20lbs, 368 mm x 762 mm x 102 mm, 20A120BC: National Fire Equipment Ltd. Model CE-950-1; Wilson & Cousins Inc. Model IE10C;

.3 **Recessed:** Rectangular cabinet with a 1.2 mm (18 gge) corrosion resistant white enamelled steel tub, 1.9 mm (14 gge) cleaned and prime coat painted steel door and adjustable trim assembly with rounded corners, semi-concealed piano hinge, safety glass panel, and flush stainless steel door latch. Acceptable products are:

.1 5lbs, 203 mm x 432 mm x 127 mm, 3A10BC: National Fire Equipment Ltd. Model 102F; Wilson & Cousins Inc. Model FEC 05 complete with Front-FXC-05

.2 10lbs, 229 mm x 610 mm x 152 mm, 6A80BC/10BC: National Fire Equipment Ltd. Model CE-950-1/CE-950-2; Wilson & Cousins Inc. Model IE100-R2

.3 20lbs, 368 mm x 762 mm x 102 mm, 20A120BC: National Fire Equipment Ltd. Model CE-950-4

.4 Outdoor Surface Mounted: Rectangular, ABS cabinet, dent, rust and corrosion proof complete with brass lock, cover and labels

.5 Acceptable products are:

.6 5lbs, 210mm x 520mm x 130mm, 3A10BC: Steel Fire Equipment Ltd. Brooks ABS Cabinet Model MJWC

.7 10lbs, 238mm x 622mm x 130mm, 6A80BC/10BC: Steel Fire Equipment Ltd. Brooks ABS Cabinet Model MJWC

2.7 FIRE BLANKETS

.1 Equal to National Fire Equipment Ltd. Model #FB-6078 “BATTLEBLAZE” 1500 mm x 2000 mm (60" x 78") non-combustible glass fibre fire blanket with straps and a Model #FB-6078-MC flush wall mounting storage cabinet with identified face.

3 Execution

3.1 INSTALLATION OF FIRE EXTINGUISHERS

.1 Provide fire extinguishers of the type(s) indicated in the locations shown.

.2 Unless otherwise shown or specified, wall mounted extinguishers using wall brackets supplied with the extinguishers.

.3 Do not install extinguishers until after wall finishing work is complete.

.4 This contractor will be responsible for fire extinguishers until after issue and receipt of a Certificate of Substantial Performance of the Work.

.5 If extinguishers are indicated adjacent door, locate the extinguishers at the strike side of the door.

.6 Fire extinguishers having a gross weight not exceeding 18.14 kg (40 lb) shall be installed so that the top of the fire extinguisher is not more than 1.53 m (5 f t) above the floor.

.7 Fire extinguishers having a gross weight greater than 18.14 kg (40 lb) shall be installed so that the top of the fire extinguisher is not more than 1.07 m (3 ft) above the floor.

.8 In no case shall the clearance between the bottom of the fire extinguisher and the floor be less than 102 mm. (4 in).

3.2 INSTALLATION OF FIRE EXTINGUISHER CABINETS

.1 Provide wall cabinets for fire extinguishers where shown.

.2 Unless otherwise shown or specified, locate cabinets so that the centerline is approximately 1200 mm (48") above the finished floor.

.3 Confirm exact locations prior to installation.

3.3 INSTALLATION OF FIRE BLANKETS

.1 Provide fire blankets in the Kitchen where shown. Store each blanket in a flush wall mounted cabinet. Confirm exact locations prior to installation.

END OF SECTION

1 General

1.1 GENERAL REQUIREMENTS

.1 General Conditions, Supplementary Conditions and Division 01 apply to this Section.

1.2 SUMMARY

.1 This Section includes requirements for supply and installation of metal lockers, benches and accessories required for a complete and functioning installation.

1.3 REFERENCES

.1 All references standards specified herein imply the latest edition of the standards.

.2 American Society for Testing and Materials (ASTM) A1008 - Standard Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.

.3 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ADAAG - American with Disabilities Act, Accessibility Guidelines.

.5 ANSI A117.1 - Accessible and Usable Buildings and Facilities

1.4 SUBMITTALS

.1 Action Submittals: Provide the following submittals before starting work of this section:

.1 Product Data: Submit product data from manufacturer indicating proposed components and installation requirements.

.2 Shop Drawings: Show and describe in detail materials, finishes, dimensions, details of connections and fastenings elevations, plans, sections, metal thicknesses, hardware and any other pertinent information.

.3 Samples:

.1 Submit duplicate 12" X 12" samples of panel showing finish on both sides, two finished edges and core construction.

.2 Submit duplicate representative samples of each hardware item, including brackets, fastenings and trim.

.4 Submit necessary templates and instructions where supports or anchors have to be built-in by others.

.2 Provide maintenance data for maintenance of metal finishes work for incorporation into Maintenance Manual.

1.5 ADMINISTRATION REQUIREMENTS

.1 Coordination: Coordinate site dimensions affecting work of other Sections and provide data, dimensions and components, anchors and assemblies installed by other Sections in sufficient time for installation of products specified in this Section.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver, handle and store prefabricated units in accordance with manufacturer's directions.

.2 Store units at site on raised wood pallets protected from the elements and corrosive materials, and Do not remove from crates or other protective covering until ready for installation.

2 Products

2.1 APPROVED PRODUCTS AND MANUFACTURERS

.1 Basis-of-Design Products: Products named in this Section were used as the basis-of-design for the project; additional manufacturers offering similar products may be incorporated into the work of this Section provided they meet the performance requirements established by the named products and provided they submit requests for substitution in accordance with Section 01 33 00 – Submittal Procedures.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 ASI Storage Solutions Inc.

.2 GSS (General Storage Systems)

.3 Hadrian Manufacturing Inc.

.3 Metal Lockers:

.1 Size: Nominal 300mm (12”) wide x 450mm (18”) deep x 1830mm (72”) high.

.2 Construction:

.1 Doors: One piece double wall envelope construction, minimum 0.9mm (20 gauge) thick, welded construction, complete with recessed handle box.

.2 Frame: Minimum 1.6mm (16 gauge) steel channel, welded construction complete with 2.9mm (11 gauge) padlock hasp.

.3 Body: Minimum gauge requirements:

.1 Bottoms: 1.6mm (16 gauge).

.2 Sides, Backs, and Shelves: 0.5mm (24 gauge).

.3 Bolt Spacing: 230mm (9”) o.c. maximum spacing.

.4 Handle: Recessed lock pocket, one piece construction, 0.9mm (20 gauge).

.5 Tops: Flat, continuous overtop of a bank of lockers, 1.2mm (18 gauge).

.6 Hinge: Continuous, full length 1.6mm (16 gauge) piano hinge riveted to both door and frame.

.3 Configuration: Double tier.

.4 Basis of Design Product:

.1 Traditional Collection by ASI Storage Solutions Inc.

.2 Deluxe Series Locker by Shanahan's Building Products

.3 Décor Tri-Lok Eclipse II Metal Locker by General Storage Systems Ltd.

.4 Benches:

.1 Stationary Bench: Prefinished steel tube pedestal, 38mm (1-1/2”) diameter steel tubing with 3.2mm (10 gauge) steel flanges welded to each end.

.2 Length: As indicated on Drawings.

.3 Pedestal Spacing: Minimum 1200mm (4') o.c.

.4 Wood Tops: 32mm (1-1/4”) thick laminated maple hardwood strip bench top with bullnosed edges and 2 coats clear polyurethane finish.

.5 Manufacturer: To match manufacturer of Metal Lockers specified above.

2.2 MATERIALS

.1 Sheet Steel: Cold rolled carbon steel, commercial quality stretcher levelled or temper rolled to stretcher levelled standard of flatness free from surface imperfections and conforming to ASTM A366/A336M-91.

.2 Locker Paint: Electrostatically applied, thermo-setting, high performance primer and powder coating.

.3 Welding Materials: Conforming to CSA W59.

.4 Fasteners: Non-corrosive type.

.5 Hardwood: AWMAC premium grade, "Maple species.

.6 Hardwood Laminating Adhesive: Water resistant urea-formaldehyde resin type conforming to CSA 0112 Series-M, Type 1.

.7 Steel Tube: Conforming to ASTM A53-906.

.8 Steel Plate: Conforming to CAN/CSA-G40.20/G40.21, Grade 44W.

.9 Chromeplating: Chrome plating on steel by "electroplating" method, with plating sequence as follows; 8.9um (0.00035") thickness of Copper, followed by 10um (0.00039") thickness of Nickel, followed by 16um (0.00064") thickness of Chromium.

.10 Polyurethane Coating: Oil modified, clear gloss or stain interior type conforming to CAN/CGSB-1.175-M.

2.3 FINISHES

.1 Lockers:

.1 Specially treat metal locker surfaces by phosphate conversion process conforming to CGSB 31-GP-105a, ready to receive locker paint finish.

.2 Electrostatically apply locker paint to all metal locker surfaces. Colours as selected by Consultant from manufacturer’s standard product range.

.2 Bench Tops:

.1 Two coats of clear polyurethane coating. Lightly sand surfaces and wipe with tack rag before applying second coat.

.3 Bench Frames:

.1 Chromeplated after fabrication.

2.4 FABRICATION

.1 General: Make work square, plumb, straight and true. Make joints and intersections tightly fitted and securely fastened.

.2 Finish: All parts to be thoroughly degreased, cleaned and given a bonding, rust-retarding phosphate coat and two finish coats of powder coating. Material then to be baked to produce a hard durable finish.

.3 Body: End sides to have double bend at front edge to add stiffness. Front edge of shelf to be bent to prevent small items from rolling off.

.4 Filler Panels: Minimum 0.9mm (20 gauge) sheet steel, powder coated to match locker colour. Extend filler panels from finished floor to top of sloping top. Top of panel to be same slope as sloping top. Secure panels from inside of lockers.

.5 Door Frames: Vertical members to have three right angle bends to reduce the danger of exposed edges and add strength. Horizontal members to be bent to channel shape of 19mm x 63mm x 19mm (3/4" x 2-1/2" x 3/4"). Weld parts together to form a strong, rigid unit. Provide two rubber bumpers on lock side of frame approximately 38mm (1-1/2") from top and bottom of door.

.6 Doors: Fully enclosed at rear with a flush minimum 0.42mm (27 gauge) thick reinforcing sheet to form a closed box and make a rigid, whip-free unit. Face of door to be free from protruding handles, locks, louvers, etc.

.7 Bases (where concrete bases are not indicated): 1.2mm (18 gauge) sheet steel, powder coated to match locker colour, 100mm (4") high, complete with top and bottom legs and intermediate vertical steel reinforcement at back.

.8 Commercial Locker Ventilation: Cut slots at top and bottom of each locker to allow air to flow freely in and out of entire locker from bottom to top.

.9 Locking and Latching: Make provision for locking with a standard combination padlock arrangement with no moving parts. Entire lock pocket recess shall be nickel plated with durable black nylon-coated pull and nylon type No. 6 friction catch permanently fixed in door with hidden fastener and aligned to accept plunger and hold door in closed position. Padlock: Supplied by Owner.

.10 Number Plates: Black with bright contrasting block numerals on polished aluminum plate, riveted to door face, recessed into door. Numerals shall not less than 19mm (3/4") high and non-erasable. Lockers shall be numbered as indicated later by the Consultant.

.11 Interior Equipment: One hat shelf, two wall hooks, 3 wall mounted die cast zinc plated finish ceiling hook attached to centre of locker shelf.

.12 Hardware: Vandal resistant cadmium plated nuts, bolts, lock washers, nut covers, angle clips and fastenings.

3 Execution

3.1 EXAMINATION

.1 Do not begin installation until substrates and bases have been properly prepared.

.2 Notify Consultant if substrate and bases are of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

.1 Install metal lockers and accessories at locations shown in accordance with manufacturer's instructions.

.2 Install lockers level and plumb with flush surfaces and rigid attachment to anchoring surfaces.

.3 Anchor lockers to floor and wall at 48" or less, as recommended by the manufacturer.

.4 Bolt adjoining locker units together to provide rigid installation.

.5 Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.

.6 Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.

.7 Install benches by fastening bench tops to pedestals and securely anchoring to the floor using appropriate anchors for the floor material. Install free standing benches to locations indicated on drawings.

3.3 ADJUSTING AND CLEANING

.1 Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

.2 Touch-up with factory-supplied paint and repair or replace damaged products before Substantial Completion.

3.4 PROTECTION

.1 Protect installed products until completion of project.

END OF SECTION

1 General

1.1 REFERENCES

.1 Conform to Division 1, General Requirements

1.2 CODES, STANDARDS AND LAWS

.1 All work shall be carried out in accordance with the applicable regulations of the following authoritative bodies, codes in effect at the time of Tender, and any other Authority having jurisdiction:

.1 Ontario Building Code

.2 Ontario Plumbing Code

.3 Fire Marshall

.4 Worker's Compensation Board

.5 Local Building By-Laws

.6 Canadian Standards Association

.7 CSA Gas Code B149.1

.8 CSA Mechanical Refrigeration Code B52

.9 Canadian Safety Standard (CSA):

.1 CAN/CSA C22.2.CAN/CSA C747, Energy Efficiency Test Methods for Small Motors.

.2 CAN/CSA C390, Test methods, marking requirements and energy efficiency levels for three-phase induction motors.

.10 Electrical Equipment Manufacturers' Association Council (EEMAC).

.11 Institute of Electrical and Electronic Engineers (IEEE).

.1 IEEE 112, Standard Test Procedure for Polyphase Induction Motors and Generators.

.12 National Electrical Manufacturers Association (NEMA).

1.3 WORK STANDARDS

.1 All Codes and Standards referred to in this Section are the latest edition of the Codes and Standards in effect at the time of tendering this Contract.

.2 All mechanical piping system Work, including equipment, must comply in all respects with requirements of the Ontario Technical Standards and Safety Authority, and CSA Standards B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, fittings, valves, equipment, etc., must bear a CRN number.

.3 All electrical items associated with mechanical equipment shall be CSA (or equivalent agency certified electrically), or bear a stamp to indicate special Electrical Safety Authority approval.

1.4 DEFINITIONS

.1 The following are definitions of words found in Sections of Divisions 20, 22, and 23 and on associated Drawings:

.1 "Concealed" – means Work hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "Exposed" – means Work normally visible, including Work in equipment rooms and similar spaces.

.3 "Provide" (and tenses of "provide") – means supply and install complete.

.4 "Install" (and tenses of "install") – means install and connect complete.

.5 "Supply" – means supply only.

.6 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished.

.2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the Specification Sections they are understood, unless otherwise defined in the Contract Documents, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the Drawings.

.3 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the Specification Sections they are understood, unless otherwise defined in the Contract Documents, to mean that Work or product referred to is "approved by", "inspected by", etc., the Consultant.

1.5 WORKPLACE SAFETY

.1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials.

.2 Comply with all requirements of O.Reg 213/91, Construction Projects, enacted under the Occupational Health and Safety Act.

1.6 APPLICATION

.1 This Section specifies requirements, products, common criteria and characteristics, and methods and execution that are common to one or more Sections of Divisions 20, 22, and 23, and it is intended as a supplement to each Section and shall be read accordingly

1.7 PLANNING AND LAYOUT OF WORK

.1 The exact locations and routing of mechanical and electrical services shall be properly planned, coordinated and established with all affected trades prior to installation such that the services will clear each other as well as any obstructions. Generally, give the right-of-way to piping requiring uniform pitch and locate and arrange other services to suit.

.2 All shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings, must be located for easy access for servicing and/or removal. Products which do not meet the location's requirements shall be relocated at no cost to the Owner.

1.8 DOCUMENTS

.1 The Contract Drawings are performance Drawings, diagrammatic, and show approximate locations for equipment and materials. The Drawings are intended to convey the scope of work and do not necessarily show architectural and structural details. The locations of materials and equipment shown may be altered (when revised layouts have been submitted and approved), to meet requirements of the material and/or equipment, other equipment and systems being installed, and of the building. Provide all fittings, offsets, transformations, and similar items required as a result of obstructions and other architectural or structural details but not shown on the Mechanical Drawings.

1.9 ACCEPTABLE PRODUCT MANUFACTURERS

.1 Products scheduled and/or specified on the Drawings and in the Sections of Divisions 22 and 23 have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, acceptable manufacturers are stated for any product specified by manufacturer's name and model number. The Contract price may

be based on products supplied by any of the manufacturers named as acceptable for the particular product. If acceptable manufacturers are not stated for a particular product, base the Contract price on the products supplied by the specified manufacturers.

.2 If products supplied by a manufacturer named as acceptable in any Section of Divisions 22 and 23 are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted product is equivalent in performance and operating characteristics (including energy consumption if applicable) to the specified product, and, it is to be understood that any additional costs, and changes to associated or adjacent Work resulting from provision of products supplied by a manufacturer other than the specified manufacturer is included in the Contract price. In addition, in equipment spaces where products named as acceptable are used in lieu of specified products and the dimensions of such products differ from the specified products, prepare and submit for review, accurately dimensioned layouts of rooms affected.

1.10 SUBMITTALS

.1 Submit the following for review:

.1 Shop drawings for all products specified in this Section.

.2 Location drawings for all required sleeves and formed openings in new masonry walls.

.3 Samples of materials and any other items as specified in other Sections of this Division.

.4 WHMIS MSDS – Material Safety Data Sheets for all products where required, and maintain one copy at the site in a visible and accessible location and available to all personnel.

.5 A list of equipment identification nameplates indicating proposed wording and sizes.

.6 A list of pipe and duct identification colour coding and wording.

.7 A proposed valve tag chart and a list of proposed valve tag numbering and identification wording.

.8 A clean “reviewed” copy of each shop drawing for insertion into the O&M instruction manual.

1.11 SHOP DRAWINGS

.1 The following shall be read in conjunction with the wording on the Consultant's shop drawing review stamp applied to each and every mechanical work shop drawing submitted:

.1 “This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of its responsibility for errors or omissions in the shop drawings or of its responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades/subcontractors.”

1.12 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

.1 The Contractor will prepare and submit for review to the Consultant one (1) copy of:

.1 Permits, inspection certificates, and the like,

.2 Shop drawings for all mechanical equipment,

.3 Pipe leakage test sheets, manufacturer’s startup check sheets, and similar data,

.4 All required operating and maintenance instruction data,

.5 Valve tag charts,

.6 All other data specified in applicable Sections of Divisions 20, 22, and 23 of the Specification.

.2 Each manual is to be organized into the following categories:

.1 A - Project Directory

.2 B - Warranty Letter

.3 C - All applicable certifications letters

.4 D - Plumbing and Drainage

.5 F - Heating

.6 G - Ventilation and Noise Attenuation

.7 H - Building Management System

.3 The project directory is to contain the names, addresses, telephone and fax numbers of the Project Team, including:

.1 Owner,

.2 Architect,

.3 Mechanical Consultant,

.4 General Contractor,

.5 Mechanical Sub-contractors,

.6 Manufacturers and manufacturer's representatives.

.4 Sections D to G are to be divided into the following subsections:

.1 Shop Drawings

.2 Operation Procedures

.3 Maintenance Procedures

.4 Spare Parts List

.5 Trouble Shooting Guide

.6 Valve Chart (where applicable)

.7 Equipment Lists

.8 Testing and Verification Forms

.9 Certification Forms

.5 Section H is to be divided into subsections as follows:

.1 Shop Drawings

.2 As-Built Control Sequences

.3 As-Built Panel Layout and Points List

.4 All Point Log Per System

.5 Operating Procedures for all Equipment and Systems

.6 Maintenance Procedures for all Equipment

.7 Spare Parts List

.8 Software Licensing Agreements

.9 Software Manuals

.10 Software Disks

.11 Point Data and Program Disks

.12 Testing and Verification Forms

.6 The operating procedures are to be the manufacturer's recommended operating procedures for the equipment.

.7 The maintenance procedures are to include Scope of Work, frequency of activity, parts required, and necessary documentation.

.8 The spare parts list is to be the manufacturer's recommended list for maintenance purposes.

.9 The trouble shooting guide is to be the manufacturer's recommendations for the equipment.

.10 The equipment list is to include make, model, serial number, electrical characteristics, RPM, pump impeller sizes, fan belt and sheave sizes, as applicable.

1.13 RECORD DRAWINGS

.1 Submit record model and drawings identifying location of fire dampers, access doors and actual room names or numbers.

.2 Piping Elevations:

.1 Water Lines: All water lines. Invert elevations to be given at each junction, changes of direction horizontally and vertically and at every 30m run as well as type of material used.

.2 Sanitary sewers and Storm sewers.

.3 Heating, and Plumbing Lines: All piping of any size. Invert elevations to be given at each junction, at change of direction, at high and low points.

.3 All valve stations, trap stations, coils, dampers and ductwork not easily accessible.

.4 All changes which affect the operation of the mechanical system.

.5 At end of construction, the final set of PDFs shall be made available to the Owner and Consultant for review.

.6 Location, tagging and numbering of all valves except individual plumbing fixtures or equipment isolation valves.

.7 The as-built daily marked-up prints shall conform to the standards of the contract drawings and shall include all details from revision drawings, supplementary drawings, change orders, addenda and site revisions, etc. Provide controls as built drawings from controls contractor. Each white print drawing sheet shall be marked: "We hereby certify that these drawings represent the building, as built." with signatures immediately below of authorized personnel of the Contractor

1.14 EQUIPMENT AND SYSTEM STARTUP AND COMMISSIONING

.1 An independent Commissioning Agent ("Commissioning Agent") shall be retained by the Contractor to supervise the system and equipment startup and performance testing, to test and balance air and water flows, to make final adjustments to equipment and systems, to prepare operating and maintenance instruction manuals, to update CADD discs for record drawings, and to provide other associated services.

.2 The work for the independent Commissioning Agent is specified in Section 20 08 00 - Commissioning. Carefully read Section 20 08 00 and provide for all labour to physically perform start-ups and performance testing, supply of equipment manufacturer's

representatives and technicians on-site, services, etc., which are indicated as being supplied by the Contractor, including:

.1 Data and shop drawings for operation and maintenance manuals.

.2 Marked-up white print "record drawings" prepared on site during construction.

.3 All test data and certificates.

.3 The majority of the Commissioning Work specified in Section 20 08 00 must be complete prior to application for Substantial Performance of the Work.

2 Products

2.1 PIPE SLEEVES

.1 Minimum 1.6mm thick (16 ga) galvanized steel with an integral flange at one end to secure the sleeve to formwork construction.

.2 Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at the sleeve midpoint.

2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than the fire resistance rating of surrounding construction.

.2 Pipe insulation forming part of a ULC fire and smoke seal assembly is specified in Section 20 07 00.

2.3 WATERPROOFING SEAL MATERIALS

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so that when the bolts are tightened the links expand to seal the opening watertight. The seal assemblies shall be selected to suit the pipe size and the sleeve size or wall opening size. Acceptable products are:

.1 Thunderline Corp. (Power Plant Supply Co.) “LINK SEAL” Model S.

.2 The Metraflex Co. “MetraSeal” type ES.

2.4 PIPE ESCUTCHEON PLATES

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with screws, each sized to cover the pipe sleeve or wall or slab opening, and to fit tightly around the pipe or pipe insulation.

2.5 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 For exposed fan blades, unless otherwise specified in the Contract Documents - removable 12 mm (0.5”) galvanized steel wire mesh with galvanized steel frames.

2.6 COMMON ELECTRICAL REQUIREMENTS

.1 Division 26 – Electrical, shall provide all line side power wiring for equipment provided by Division 21 – Fire Suppression, Division 22 – Plumbing, Division 23 – HVAC and Division 25 – Integrated Automation, up to the respective motor control center and starters, also provided under Divisions 26.

.2 Load side power wiring shall be under Divisions 21, 22 and 23. Divisions 21, 22 and 23 shall provide all local disconnect switches, control panels and VFD's for mechanical equipment as required.

.3 Control wiring of local safeties and interlocks for packaged equipment shall be provided under the respective Sections unless otherwise specified in the Contract Documents.

.4 Conduit and wiring materials and methods shall be in strict accordance with the requirements of Division 26 - Electrical.

.5 Check all wiring diagrams and control diagrams submitted in shop drawing form. Before submitting these shop drawings to the Consultant, submit these drawings to Division 26 - Electrical Contractor for approval. Have these drawings stamped by Division 26 - Electrical Contractor as verification of their approval before forwarding to the Consultant. Co-operate in the commissioning of all electrically driven equipment with Division 26 - Electrical.

2.7 COMMON MOTORS REQUIREMENTS

.1 General:

.1 The efficiency of single phase motors to 0.746 kW (1 HP) is to be in accordance with CAN/CSA – C747. The efficiency of all three phase motors 0.746 kW (1 HP) and larger shall be equal to or exceed the NEMA Premium Efficiency designation as tested in accordance with CSA C390 or IEEE 112.

.2 Motors:

.1 Unless otherwise specified in the Contract Documents, motors shall conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards.

.2 Vertically mounted and submersible motors shall be purposely designed for mounting in this attitude.

.3 Single Phase Motors: Unless otherwise specified in the Contract Documents, motors smaller than 0.373 kW (0.5 HP) shall be 115 volt, continuous duty capacitor start type with an EEMAC 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (104°F) ambient temperature.

.4 Thermistor Protection: Motors 22.37 kW (30 HP) and larger, as scheduled in the Contract Drawings, shall be complete with a heat sensing Siemens PTC thermistor (or an approved equivalent) in the end turn of the stator winding for each phase and connected in series inside the motor with two marked leads brought out to the main motor conduit box.

.3 Drive Guards and Accessories:

.1 For V-belt drives - removable, four sided, fully enclosed, galvanized sheet steel guards in accordance with OSHA standards, complete with 115 mm (4.5") diameter tachometer openings covered with removable perforated galvanized plates at each shaft location.

.2 For flexible couplings - removable "U" shaped galvanized steel guards with a 2.3 mm (0.093") thick frame and expanded mesh face.

.3 For exposed fan blades, unless otherwise specified in the Contract Documents, removable 12 mm (0.5") galvanized steel wire mesh with galvanized steel frames.

3 Execution

3.1 INSTALLATION OF PIPE SLEEVES

.1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:

.2 In poured concrete slabs, unless otherwise specified in the Contract Documents: minimum 1.6 mm thick (16 ga) flanged galvanized steel or, where permitted by governing authorities, factory fabricated, plastic sleeves

.3 In concrete or masonry walls: Schedule 40 galvanized steel pipe.

.4 Sleeves in waterproofed slabs shall be lengths of Schedule 40 mild galvanized steel pipe in accordance with the Drawing detail. Provide waterproof sleeves in the following locations:

.5 In mechanical room floor slabs, except where on grade.

.6 In slabs over mechanical, fan, electrical and telephone equipment rooms or closets.

.7 In all floors equipped with waterproof membranes.

.8 In the roof.

.9 Size sleeves, unless otherwise specified in the Contract Documents, to leave 12 mm (½") clearance around the pipes, or where pipe is insulated, a 12 mm (½") clearance around the pipe insulation.

.10 Pack and seal the void between the pipe sleeves and the pipe or pipe insulation for the length of the sleeves as follows:

.11 Pack sleeves in fire rated construction as specified in the article entitled "INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS".

.12 Pack sleeves in non-fire rated interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound.

.13 Pack sleeves in exterior walls above grade with mineral wool and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified in the Contract Documents.

.14 Seal sleeves in exterior walls (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

.15 Sleeves in fire rated construction will be packed and sealed as part of the work of Division 7.

.16 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.

.17 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 100 mm (4") above the finished surface.

.18 "Gang" type sleeving will not be permitted.

.19 Where sleeves are provided for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of the sleeved opening.

3.2 INSTALLATION OF WATERPROOFING SEAL MATERIALS

.1 Provide watertight link type mechanical seals in exterior wall openings where shown and/or specified on the Drawings.

.2 Assemble and install each mechanical seal in accordance with the manufacturer's instructions.

.3 Periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until the seal is completely watertight.

3.3 DUCT OPENINGS

.1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.

.2 Ensure that openings for fire dampers to 600 mm (24") high are sized to suit the damper arrangement with the folding blade out of the air stream.

3.4 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.

.2 Begin to prepare such drawings immediately upon notification of acceptance of Tender and award of Contract.

3.5 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIAL

.1 Where mechanical Work penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal material installed in accordance with the ULC Firestop System requirements to seal holes and voids in the walls or slabs, as follows:

.1 Bare pipe or conduit through a floor with a circular sleeved or core drilled opening - ULC System SP115.

.2 Bare pipe or conduit through a floor with a rectangular cast or cut opening - ULC System SP116.

.3 Bare pipe or conduit through a wall with a circular sleeved or core drilled opening - ULC System SP114.

.4 Bare pipe or conduit through a wall with a rectangular cast or cut opening -ULC System SP107.

.5 Insulated pipe through a wall with a sleeved or core drilled circular opening - ULC System SP108.

.6 Insulated pipe through a wall with a rectangular cast or cut opening - ULC System SP107.

.7 Insulated pipe through a floor with a circular sleeved or core drilled opening - ULC System SP109.

.8 Insulated pipe through a floor with a rectangular cast or cut opening - ULC System SP116.

.2 Note that the insulation for insulated piping penetrating fire rated construction is specified in Section 23 07 00 and is fire rated insulation with a vapour barrier jacket, ULC listed as a firestop component for use with ULC Systems SP107, SP108, SP109, and SP116.

.3 At all fusible link damper locations in ductwork penetrating fire rated construction, seal the perimeter of the angle iron framing on both sides of the wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.

3.6 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitable secured over all exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

3.7 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide all fastening and securing hardware required for mechanical Work to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.

.2 Use fasteners compatible with the structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure that is to support the products. Provide reinforcing or connecting supports where required to distribute the loading to the structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with the requirements of CSA Standards CAN3-Z166.1 and 2-M85.

3.8 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 Protect all exposed accessible rotating parts on all mechanical equipment with a guard.

.2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

3.9 INTERRUPTIONS TO AND SHUT-DOWNS OF MECHANICAL SERVICES AND SYSTEMS

.1 Co-ordinate all shut-downs and interruptions to the existing mechanical systems. Generally, shut-downs may be performed only between the hours of 12:00 midnight Sunday until 6:00 a.m. Monday morning.

.2 Upon award of the contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform the Owner in writing 72 hours in advance of the proposed shut-down or interruption and obtain written approval from the Owner to proceed. Do not shut-down or interrupt any system or service without such written approval.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible. Prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

3.10 EQUIPMENT BASES AND SUPPORT

.1 Unless otherwise specified in the Contract Documents, set all floor mounted equipment on 100 mm (4") high concrete housekeeping pads 100 mm (4") wider and longer than the equipment base dimensions.

.2 Supply dimensioned drawings, equipment base templates and anchor bolts for proper setting and securing of equipment on pads, and be responsible for all required leveling, alignment, and grouting of the equipment.

.3 For equipment not designed for base mounting, where required, provide prime coat painted structural steel stands flange bolted to housekeeping pads.

.4 Provide prime coat painted structural black steel angle or channel frames and brackets for all surface wall mounted equipment not specifically designed for surface wall mounting, unless otherwise specified in the Contract Documents.

3.11 EXCAVATION AND BACKFILL WORK

.1 Excavation, backfill and related Work such as dewatering required for the mechanical Work will be performed as part of the Work of Division 2, except for final hand grading Work which is to be performed as part of the Work of Division 23.

.2 Inverts and locations of existing site services have been shown on the Drawings. The inverts and locations shown are approximate, and it is your responsibility to confirm and satisfy yourself that the inverts and locations as shown are correct, prior to commencing site service Work.

.3 Accurately mark-out the location and routing of excavation required for the work of this Section, as well as the required depth.

.4 Ensure that all underground piping subject to freezing and located outside the building has a minimum of 1.5 m of cover.

.5 Ensure that all underground piping subject to freezing and located inside the building in unheated areas has a minimum of 450 mm of cover.

.6 Ensure that pipe bedding is proper prior to laying pipes. Hand excavate under pipe hubs, couplings, flanges and similar items to ensure even bearing along the entire barrel of each length of pipe.

.7 Ensure that piping is inspected, leakage tested and approved prior to backfilling. Supervise the initial backfilling operation to ensure that the buried Work is not disturbed.

3.12 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

.1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:

.1 Pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal.

.2 Pack and seal openings in fire rated walls and slabs as specified in this Section.

.3 Pack and seal openings in exterior walls with mechanical link type waterproofing seal materials specified in PART 2 of this Section.

3.13 HOISTS AND SCAFFOLDS

.1 Provide interior movable or roller scaffolds for the installation of the mechanical work.

3.14 ACCESS OF EQUIPMENT

.1 Make all arrangements to ensure that access into the building is available for all mechanical equipment. Do all hoisting and rigging into place of all specified equipment and be responsible for any damages incurred.

3.15 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and material in storage on site 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 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.6 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

3.16 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Owner of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

3.17 SEMI-FINAL AND FINAL INSPECTIONS

.1 Perform the following items prior to semi-final inspection:

.1 Make heating and air conditioning systems capable of operation with automatic controls in operation generally, but not necessarily finally calibrated.

.2 Make necessary tests on equipment including those required by authorities having jurisdiction. Obtain certificates of approval.

.3 Rough balance air systems.

.4 Completely identify equipment so as to be clearly visible.

.5 Lubricate equipment as per manufacturer's data.

.6 Mail warranty forms to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.

.7 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.

.8 Review and ensure access doors are suitably located and of correct type and equipment is easily accessible including plumbing cleanouts.

.9 Clean fan plenums, remove temporary filters and install permanent filters.

.10 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.

.2 Prior to semi-final inspection, provide complete list of items which are deficient at the time of the semi-final inspection.

.3 Provide declaration in writing that deficiencies noted at time of semi-final inspection have been corrected and the following items completed prior to the final inspection:

.1 Clean equipment both inside and out and lubricate.

.2 Clean plumbing fixtures and brass.

.3 Complete final balancing.

.4 Submit rough data of balance reports.

.5 Complete final calibration.

3.18 SUBSTANTIAL COMPLETION INSPECTION

.1 Prior to the Contractor requesting an inspection for substantial completion all the following items must be provided to permit beneficial use by the Owner.

.1 Maintenance and Operating Manuals to be submitted and approved.

.2 Record drawings.

.3 Air balancing reports.

.4 All motor name plate ratings and actual operating amps and voltages.

.5 All systems shall be certified in writing by the Contractor as complete and fully operational.

.6 Instructions to the Owner's operating personnel shall be provided in accordance with the specifications. A signed statement to this effect, countersigned by the Owner, shall be submitted to the Architect.

.7 A complete list of items which the Contractor has not finished, or are deficient shall be provided. If, in the opinion of the Engineer, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.8 The Contractor shall be fully responsible to accumulate all necessary data from this Sub-trades and suppliers and present same in the specified format for the approval by the Engineer.

3.19 INSTRUCTIONS TO OWNER

.1 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment specified in this Division.

.2 Arrange and pay for the services at the site of qualified technicians and other manufacturer's representatives to instruct on specialized portions of the installation.

.3 Submit, prior to issue of a Certificate of Substantial Performance, a complete list of systems for which instructions where given to the Owner, stating for each system:

.1 Date instructions were given to the Owner's staff;

.2 Duration of instruction;

.3 Names of persons instructed;

.4 Other parties present (manufacturer's representatives, etc.).

.4 Obtain the signatures of the Owner's staff to verify that they properly understood the system installation, operation and maintenance requirements and have received operating and maintenance manuals and record Drawings.

3.20 COMMON MOTOR REQUIREMENTS

.1 Manufacturer’s Instructions:

.1 Compliance: comply with Manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

.2 Installation of Equipment Drive Guards and Accessories:

.1 Protect all exposed accessible rotating parts on all mechanical equipment with a guard.

.2 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section covers the work of designing, fabrication and installation of pipe support systems for process and building mechanical piping systems unless the pipe support has been detailed elsewhere in the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 20 05 48 – Vibration & Noise Control.

.3 Section 22 11 19 – Domestic Water Piping.

.4 Section 22 11 20 – Drainage, Waste and Venting Piping.

.5 Section 23 31 00 – HVAC Ducts, Plenums.

.6 Section 23 57 19 – Hydronic Piping.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

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

.2 Manufacturers Standardization Society

.1 ANSI/MSS SP-58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Applications and Installation.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 ANSI/SMACNA 006, HVAC Duct Construction Standards - Metal and Flexible

.4 National Building Code of Canada (NBC)

.5 Ontario Building Code 2012 (OBC)

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 The Contractor shall submit shop drawings and design calculations showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall be sealed and signed by a professional engineer licensed to practice in the Province of Ontario.

.2 The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the project Structural Engineer’s Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.

.3 The drawings shall identify each support, hanger, guide, and anchor type by catalogue number and Shop Drawing detail number. No anchor points shall be permitted without reviewed shop drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

.4 Metal Framing Support Systems: Detailed installation drawings, catalogue information, and complete component specifications.

.3 Information Submittals: Maintenance information on the piping support system.

1.5 DESIGN REQUIREMENTS

.1 General:

.1 Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.

.2 Hangers, supports, anchors, guides, and restraints shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment.

.3 The piping support design shall meet the requirements of ANSI/MSS SP-58, "Pipe Hangers and Supports Materials, Design, Manufacture, Selection, Applications and Installation" or as modified by this Section.

.4 Revisions to support systems resulting from changes in the related piping system layout or by the addition other piping accessories (eg. flexible joints) as may occur during the execution of the Work, and shall be included in the Contractor's design.

.2 Pipe Support Systems:

.1 The Contractor shall select and design within the spans and component requirements specified in the Contract Documents.

.2 Generally, the piping supports specified to be designed, supplied and installed by the Contractor are not shown on the Contract Drawings. The absence of pipe supports and details on the Contract Drawings shall not relieve the Contractor of its responsibility for sizing and providing supports.

.3 Criteria for Structural Design and Selection of Pipe Support System Components:

.1 Dead loads imposed by the weight of the pipes filled with water, except air and gas pipes within the specified spans and component requirements, plus any insulation.

.2 Safety Factor for drilled-in Concrete Anchors (for example, Hilti type anchors): Minimum of 5.

.4 The Contractor shall design, size, and space support anchoring devices, including lateral supports, anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

.5 Any modification to the piping, including the addition of flexible joints where not shown on the Contract Drawings, shall require the review and approval of the support system by the Consultant.

.6 Steel Framing Support System:

.1 Bending Members: Size such that beam stress does not exceed allowable stresses in accordance with the requirements of the OBC and maximum deflection does not exceed 1/240 of span.

.2 Compression Members: Size in accordance with the manufacturer's recommended method.

.3 Support Loads: Calculate using weight of pipes filled with water.

.3 Pipe Support Spacing:

.1 Vertical Supports: Stainless steel, mild steel, ductile iron, cast iron and copper piping (Note that this spacing may require the use of higher load pipe clamps and more than a single point anchor point in concrete).

.1 Unless otherwise specified or shown maximum pipe support spacing shall be in accordance with Table 4 in MSS SP-58 or the table below:

Table 1: Maximum Horizontal Pipe Hanger Spacing

Pipe Diameter		Max. Spacing Stainless Steel, Mild Steel & Ductile Iron		Max. Spacing Cast Iron		Max. Spacing Copper	
mm	in.	meters	feet	meters	feet	meters	feet
to 25	to 1	2.1	7	2.1	7	1.5	5
32 to 40	1¼ to 1½	2.1	7	2.1	7	1.8	6
50 to 100	2 to 4	3.0	10	3.0	10	2.4	8
150 to 250	6 to 10	4.2	14	3.0	10	3.6	12
250 & up	10 & up	Spaced as required by the Contractor’s design calculations					

.2 Support pipe at changes in direction or elevation and adjacent to flexible joints, couplings, fittings, and valves within 610mm (24 in.) on each side on pipes over 40mm (1½ in.) diameter.

.2 Lateral Supports: Tie-rods in two directions or combined tension/compression members.

.3 Plastic and Fibreglass Piping:

.1 Maximum support spacing: As recommended by the manufacturer for the flow temperature in pipe.

.2 Minimum Hanger Rod Sizing: Same as listed for copper pipe.

.4 Pipe Support Hanger Rods: Galvanized steel (unless otherwise specified in the Contract Documents), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58 or the table below. When supporting multiple pipe runs rod size to be in accordance with the Contractor’s design:

Table 2: Minimum Rod Diameters for Single Rigid Rod Hangers

Pipe Diameter		Hanger Rod Diameter	
mm	in.	mm	in.
to 50	to 2	9mm	3/8
65 to 75	2½ to 3	12mm	1/2
100	4	16mm	5/8
150	6	19mm	3/4
200 to 300	8 to 12	22mm	7/8

.5 Thrust Restraint:

.1 Thrust Blocks and Ties: For specified piping systems, thrust blocks, and ties at pipe joints, which are unable to transmit thrust forces, may be shown on the Contract Drawings.

.2 Piping systems shall be analyzed and designed by a professional engineer licensed to practice in the Province of Ontario, engaged by and paid by the Contractor. Such piping systems shall be provided with thrust blocks, ties and/or other restraint systems as required to resist all internal and external forces on the piping system. The Contractor-provided design shall provide as part of the shop drawing submittal process information on lateral deflection, axial strain and any resulting unbalanced forces on equipment or connecting piping systems.

.6 Duct Support Spacing:

.1 Unless otherwise specified or shown maximum duct support spacing and hanger construction shall be in accordance with Chapter 5 of SMACNA or the table below:

Table 3: Maximum Horizontal Duct Hanger Spacing

Duct Dimension	**Hanger Construction**
Horizontal rectangular duct	
Up to 1500 mm (60 in.) for Low Pressure Ductwork Only	Two 25 mm (1 in.) x 16 US gauge straps with two screws on side of duct one screw on bottom. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
For all sizes of Medium and High Pressure Ductwork up to 3000 mm (120 in.) and Low Pressure Ductwork from 1525 mm to 3000 mm (61 in. to 120 in.)	50 mm x 50 mm x 6 mm (2 in. x 2 in. x 1/4 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
3000 mm to 6000 mm (120 in. to 240 in.)	65 mm x 65 mm x 5 mm (2-1/2 in. x 2-1/2 in. x 3/16 in.) trapeze hanger with two 9 mm (3/8 in.) dia. rods. Hangers shall be at each joint but in no case more than a maximum 1200 mm (48 in.) on centres.
Horizontal round duct	
Up to 450 mm (18 in.)	One 25 mm (1 in.) x 16 US gauge hanger ring supported from one 25 mm (1 in.) x 16 US gauge hanger strap. Hanger shall be at each joint but in no case more than a

	maximum 2400 mm (96 in.) on centres.
475 mm to 900 mm (19 in. to 36 in.)	One 25 mm (1 in.) x 12 US gauge hanger ring supported from 25 mm (1 in.) x 12 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
925 mm to 1250 mm (37 in. to 50 in.)	One 25 mm (1 in.) x 12 US gauge hanger ring supported from 25 mm (1 in.) x 12 US gauge hanger strap. Hanger shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.
1275 mm to 2100 mm (51 in. to 84 in.) Support	Two 40 mm (1-1/2 in.) x 12 US gauge hanger connected to the 32 mm x 32 mm x 3 mm (1-1/4 in. x 1-1/4 in. x 1/8 in.) angle girth reinforcing of duct hanger. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.

all vertical ducts at each floor, on all sides, with angle riveted to the ducts.

.3 Support all horizontal ducts within 610mm (24 in.) of each elbow and within 1200mm (48in.) of each branch intersection.

.4 Flexible duct lengths greater than 2,400 mm (84 in.) shall be supported at the midpoint with strap hangers.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 Pipe hanger and support materials, including accessories, shall be, unless otherwise specified in the Contract Documents, constructed in accordance with the MSS Standard Practice Manual SP-58, “Pipe Hangers and Supports – Materials, Design and Manufacture”, and, where possible, MSS designations are indicted with each product.

.2 Ductwork hanger and support materials, including accessories, shall be, unless otherwise specified in the Contract Documents, constructed in accordance with the SMACNA, “HVAC Duct Construction Standards”.

.3 All pipe hangers and exposed ductwork hangers shall be zinc plated unless otherwise noted in the Contract Documents.

.4 Hangers and supports for insulated piping and ductwork shall be sized to fit around the insulation and covering.

.5 All pipe hangers and supports shall be manufactured to the latest requirements of MSS-SP-58. Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME Code for Pressure Piping B31.1

.6 When specified proprietary pipe support items are not available, fabricate pipe supports of the specified material and to the general configuration indicated by the Contract Drawings.

.7 Special support and hanger details as designed by the Contractor may be used for cases where standard catalogue supports are inapplicable or unpractical.

2.2 HORIZONTAL SUSPENDED PIPING

.1 Adjustable Clevis Type: MSS SP 58, Type 1.

.1 Anvil International Inc.; Fig. 260

.2 Cooper B Line Inc.; Fig. B3102

.2 Adjustable Split Ring Pipe Clamp: MSS SP 58, Type 6 or 12.

.1 Anvil International Inc.; Fig. 104

.2 Cooper B Line Inc.; Fig. B3198H

.3 Adjustable Swivel Ring Band: MSS SP 58, Type 10

.1 Anvil International Inc.; Fig. 69

.2 Cooper B Line Inc.; Fig. B3170

.4 Adjustable Roller Hanger c/w Steel Protection Saddle: MSS SP 58, Type 41, 43 or 45 c/w Type 39

.1 Anvil International Inc.; Fig. 171, 177 or 181 c/w Figure 160 to 166A

.5 Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.

.6 See section 2.3 “Trapeze Support System”

2.3 TRAPEZE TYPE SUPPORT SYSTEMS

.1 Trapeze Hanger/Support: MSS SP 58, Type 59

.2 Channel Size: As designed by contractor. Minimum 12 gauge, 1 5/8 inch wide steel. Minimum 1 1/2 inch wide FRP.

.3 Members and Connections: Design for all loads with safety factor of 5.

.4 Pipe Anchors Type: Galvanized steel anchor chair with U bolt strap.

.5 Manufacturers:

.1 Anvil International Inc.; Power Strut.

.2 Cooper B Line Inc.; Strut System.

.3 Unistrut Corporation.

.4 TYCO Inc. - Aickenstrut (FRP).

.5 Gripple Inc.

2.4 HORIZONTAL PIPE ON VERTICAL SURFACES:

.1 Steel offset pipe clamp:

.1 Anvil International Inc.; Fig. 103

.2 E. Myatt & Co. Inc. Fig. 170

.2 J-Hanger, MSS SP 58, Type 5:

.1 Anvil International Inc.; Fig. 262

.2 Cooper B Line Inc.; Fig. B3690

.3 See section 2.5 “Wall Brackets”

2.5 WALL BRACKETS

.1 Welded Steel Bracket: MSS SP 58 and SP 69, Type 33 (heavy-duty).

.1 Anvil International Inc.; Fig. 199

.2 Cooper B Line Inc.; Fig. B3067

.2 Pipe Anchors Type: Galvanized steel anchor chair with U bolt strap.

.3 One Hole Clamp: Anvil International Inc.; Figure 126.

.4 Channel Type:

.1 Unistrut Corporation.

.2 Anvil International Inc.; Power Strut.

.3 Cooper B Line Inc.; Strut System.

.4 TYCO Inc. - Aickenstrut (FRP).

.5 Gripple Inc.

2.6 VERTICAL RISERS THROUGH FLOORS:

.1 Riser clamp, MSS SP 58, Type 8:

.1 Anvil International Inc.; Fig 121,

.2 E. Myatt & Co. Inc. Fig. 151

.2 Heavy-duty steel riser clamp MSS SP 58, Type 8:

.1 Anvil International Inc.; Fig. 261

.2 E. Myatt & Co. Inc.; Fig's. 182,183, 190 and 191

.3 Base of Vertical Risers: Support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment shall consist of a base elbow support with flange Empire Tool & Mfg. Co. Fig. 830 or approved equivalent.

2.7 VERTICAL PIPING ON VERTICAL SURFACES:

.1 Adjustable Split Ring Pipe Clamp: MSS SP 58, Type 6 or 12.

.1 Anvil International Inc.; Fig. 104

.2 Cooper B Line Inc.; Fig. B3198H

.2 Steel offset pipe clamp:

.1 Anvil International Inc.; Fig. 103

.2 E. Myatt & Co. Inc. Fig. 170

.3 Heavy-duty steel pipe strap: MSS Type 26

.1 Anvil International Inc.; Fig. 262

.2 E. Myatt & Co.; Fig. 161

2.8 PIPE GUIDES

.1 Intermediate Guides:

.1 Piping 150 mm and Smaller: Specify the use of pipe clamp with oversize pipe sleeve to provide a minimum of 3 mm of clearance.

.1 Manufacturers:

.1 Kin Line, Inc., Figure 417.

.2 Grinnell (division of Tyco Fire Products LP): Power Strut, Figure P5932.

.2 Piping 200 mm and Larger: Specially formed U bolts with double nuts to provide a minimum clearance of 6 mm around pipe.

.1 U Bolt Stock Size:

.1 200 mm Pipe: 16 mm U bolt.

.2 250 mm Pipe: 400 mm U bolt.

.3 300 through 400 mm Pipe: 22 mm U bolt.

.4 450 through 760 mm Pipe: 25 mm U bolt.

.2 Alignment Guides:

.1 Piping 200 mm and Smaller: Galvanized steel spider or sleeve type.

.2 Piping 250 mm and Larger: Galvanized roller type guides.

.3 Manufacturers:

.1 Vibrant Power Inc.

.2 Senior Flexonics Canada Ltd.

.3 Kin-Line Inc.

2.9 THERMAL BREAKS

.1 All insulated piping shall be provided with a continuous thermal break between the outer pipe diameter and the pipe hanger/support.

.2 Calcium silicate (or approved equivalent high density insulation) pre-insulated support shield c/w galvanized steel jacket.

.3 Manufacturers:

.1 Cooper B Line Inc.; B3380 thru B3387

.2 National Pipe Hanger Corp.; Pro-Shield

2.10 ACCESSORIES

.1 I-Beam Clamp: Concentric loading type, MSS SP 58, Type 21, 28, 29, or 30, which engage both sides of flange.

.2 Concrete Insert: MSS SP 58, Type 18, continuous channel insert with load rating not less than that of the hanger rod it supports.

.3 Concrete Anchors: Hilti (Canada) Co. type HIT or HSL anchors of size and numbers to resist the design loads based on a Factor of Safety (FOS) of 5.

.4 All fasteners to be sized by the equipment manufacturer.

.5 Insulation Saddle:

.1 Type: Galvanized steel or stainless steel, MSS SP 58 and SP 69, Type 40.

.2 Manufacturers and Products:

.1 Anvil International Inc.; Figure 167.

.2 Cooper B Line Inc.; Figure B3151.

2.11 SPECIAL HANGERS AND SUPPORTS:

.1 **Vibration isolated supports** – Black steel riser clamps as specified above, complete with vibration isolation pads Vibro-Acoustics Ltd. type “NSN” between the clamp and the floor or approved equivalent.

.2 **For groups of pipes having the same slope** – Welded steel brackets Anvil Fig. 195 or approved equivalent, universal trapeze assemblies Anvil Fig. 46, or Unistrut Corporation or approved equivalent assemblies, all with U-bolts, clamps, etc., to secure pipes in place. For pipes 150 mm ("6) and greater Anvil Fig. AS 911 pipe roller with Anvil Fig. 160 to 166A – MSS SP 58, Type 39 steel protection saddle or approved equivalent.

.3 **For sections of piping connected to vibration isolated equipment** – hangers and supports as specified above but complete with MSS SP 58, Type 48 spring cushions.

.4 **For plastic piping** – generally as specified above but in accordance with the pipe manufacturer’s printed recommendations.

.5 **For bare copper piping** – generally as specified above but factory vinyl coated to prevent contact between the pipe and hanger.

3 Execution

3.1 INSTALLATION OF PIPING SUPPORTS

.1 General:

.1 Install pipe support systems in accordance with MSS SP 58, unless shown otherwise on the Contract Drawings.

.2 Support piping connections to equipment by pipe support and not by the equipment.

.3 Support large or heavy valves, fittings, and appurtenances independently of connected piping.

.4 No pipe shall be supported by any other pipe located above, below or beside it.

.5 Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

.6 Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.

.7 Install sway prevention bracing for all suspended piping in accordance with the requirements of OBC.

.8 All drilling for hangers, rod inserts and work of similar nature shall be done by Mechanical Division.

.9 Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.

.10 Repair mounting surfaces to their original condition after attachments are made.

.11 Install concrete anchors in accordance with the Manufacturer's printed instructions.

.12 Install resilient hangers in accordance with Section 20 05 48 – Vibration & Noise Control.

.2 Standard Pipe Supports:

.1 Horizontal Suspended Piping:

.1 Single Pipes: Adjustable swivel ring, split ring, or clevis hangers.

.2 Grouped Pipes: Trapeze hanger systems.

.3 Furnish galvanized steel protection shield and oversized hangers for insulated pipe.

.4 Furnish precut sections of rigid insulation with vapor barrier at hangers for insulated pipe.

.2 Horizontal Piping Supported From Vertical Surface:

.1 Single Pipes: Wall brackets or J-Hangers attached to wall with anchors. Clamps attached to wall mounted framing are also acceptable.

.2 Stacked Piping:

.1 Wall mounted framing system and clamps acceptable for piping smaller than 75 mm minimal diameter.

.2 Piping clamps that resist axial movement of pipe through support are not acceptable.

.3 Wall mounted piping clamps are not acceptable for insulated piping.

.4 Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.

.5 Standard Attachments:

.1 To Concrete Ceilings: Concrete anchors.

.2 To Steel Beams: I beam clamp or welded attachments.

.3 To Wooden Beams: Lag screws and angle clips to members a minimum of 62.5 mm thick.

.4 To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.

.3 Intermediate and Pipe Alignment Guides:

.1 Provide pipe alignment guides (or pipe supports that provide same function) at expansion joints and loops.

.2 Guide piping on each side of expansion joint or loop at 4 and 14 pipe diameters from each joint or loop.

.3 Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.

.4 Accessories:

.1 Insulation Shield: Install on insulated piping. Oversize rollers and supports.

.2 Welding Insulation Saddle: Install on insulated steel pipe. Oversize rollers and supports.

.3 Vibration Isolation Pad: Install under base flange of pedestal type pipe supports adjacent to equipment, and where required to isolate vibration.

.1 Dielectric Barrier: 6.4 mm by 75 mm neoprene rubber wrap, oversize clamps

.2 Where factory applied electrical isolation between carbon steel members and copper is not possible wrap pipe with neoprene strip at hanger

.3 Install neoprene between stainless steel supports and non-stainless steel ferrous metal piping.

3.2 INSTALLATION OF DUCT SUPPORTS

.1 All drilling for hangers, rod inserts and work of similar nature shall be done by Mechanical Division.

.2 Hang all ductwork securely and in a rigid manner. Provide hangers as described in Section 1.5 “Design Requirements”

.3 **Rectangular Duct Support Inside Building:** Support horizontal rectangular ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with galvanized steel channels and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20 in.).

.4 **Round and Flat Oval Duct Support Inside Building:** Support round and flat oval ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Unless otherwise specified in the Contract Documents, for both uninsulated and insulated ducts exposed in finished areas use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.

.5 **Flexible Duct Support Inside Building:** Unless otherwise specified in the Contract Documents support in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.3 FIELD FINISHING

.1 Paint: As specified in Section 09 91 00 – Painting.

END OF SECTION

1 General

1.1 SUMMARY

.1 This section covers the supply and installation of the complete vibration isolation system for all equipment, ductwork, and piping covered by the Mechanical Contractor.

.2 Vibration isolation system shall be fully integrated into and compatible with noise and vibration controls in accordance with 20 05 50 - Seismic Restraint Systems.

.3 This specification should be read in conjunction with Section 23 21 16 - Hydronic Piping Specialties and Section 22 11 19 - Domestic Water Piping Specialties for flexible pipe connections and Section 23 33 00 - Air Duct Accessories for the acoustical treatment of ductwork.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 20 05 29 – Hangers and Supports.

.3 Section 20 05 50 – Seismic Restraint System.

1.3 REFERENCES

.1 American Society of Heating, Refrigerating, and Air Condition Engineers (ASHRAE)

.1 ASHRAE Handbook: HVAC Applications “Chapter 43 Sound and Vibration Control”

.2 Ontario Building Code 2012 (OBC)

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 Provide the manufacturer's product literature and datasheets for all components listed in this specification.

.2 Include full details of design criteria, schematics, specifications, installation procedures and instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 All equipment provided for vibration isolation shall be new and manufactured specifically for the purpose intended.

.2 All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control or Mason Industries and shall be one manufacturer throughout the project.

.3 Provide vibration isolation with integral seismic restraint for equipment intended to provide restraint from seismic and wind forces. Housings shall be capable of withstanding the applicable design forces for the specific installation. Installation shall be in accordance with Section 20 05 50 - Seismic Restraint Systems.

2.2 VIBRATION ISOLATION

.1 **Type DDNH (Double Deflection Neoprene Hangers)**

.1 Type DDNH shall consist of a molded neoprene isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel. The diameter of the clear hole in the hanger box shall be at least 19mm larger than the diameter of the hanger rod and permit the hanger rod to swing through a 30 degree arc. When installed the hanger box shall be allowed to rotate through a full 360 degrees without encountering an obstructions.

.2 Unless otherwise specified the static deflection of DDNH hangers shall be 8mm.

.3 Acceptable Manufacturers:

.1 Vibro-Acoustics; Model RHD.

.2 Kinetics; Model RH.

.3 Mason Industries; Model HD.

.2 **Type SPH (Spring Hangers)**

.1 Type SPH shall consist of a steel spring and welded steel housing. Spring diameter and hanger box hole shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19 mm (3/4 in.) larger than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.

.2 Unless otherwise specified, the static deflection of SPH hangers under actual load conditions shall be 50 mm (2 in.).

.3 Acceptable Manufacturers:

.1 Vibro-Acoustics; Model SH.

.2 Kinetics; Model SH.

.3 Mason Industries; Model 30.

.3 **Type SPNH (Spring and Neoprene Hangers)**

.1 Type SPNH shall be as above with the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9mm with a strain not exceeding 15%. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).

.2 Acceptable Manufacturers:

.1 Vibro-Acoustics; Model SHR.

.2 Kinetics; Model SRH.

.3 Mason Industries; Model 30N.

.4 All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.

.5 Where steel spring isolation systems are described in the specifications, the mounting assemblies shall utilize bare springs with the spring diameter not less than 80% of the loaded operating height of the spring. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after spring installation.

.6 All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer, and must be linear over a deflection range of not less than 50% above the design deflection.

.7 All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.

3 Execution

3.1 GENERAL

.1 Obtain one copy of all Shop Drawings of equipment to be isolated showing weights, shaft centres and all dimensions.

.2 On system start-up, inspect the complete installation and provide a report in writing.

.3 Furnish concrete bases, including concrete fill, on springs or other vibration isolation materials for mechanical isolation.

.4 All floor mounted equipment shall be erected on concrete housekeeping pads, with thickness as identified, over the complete floor area of the equipment, unless shown or specified otherwise. Wherever vibration eliminating devices and/or concrete inertia pads are specified, these items shall be mounted on concrete housekeeping pads.

.5 Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

.6 All equipment shall be provided with lateral restraining isolators as required to limit horizontal motion to 6mm maximum, under all operating conditions. Lateral restraining isolators shall have the same static deflection as equipment being isolated.

.7 Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

.8 Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping, and blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.

.9 All mechanical equipment not specifically identified in this Section that contains rotating or vibrating elements, and any associated electrical apparatus installed by this Division that contains transformers or inductors shall be installed on Type DDNM, MEP, or EP isolators as appropriate.

.10 All wiring connections to mechanical equipment on isolators shall be made with a minimum long flexible conduit installed in a slack “U” shape.

.11 Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

.12 Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

3.2 INSTALLATION OF VIBRATION ISOLATION

.1 Unit Heaters suspended from overhead structure shall be hung on Type SPNH spring isolators. The static deflection of the isolators shall be 50 mm (2 in.).

.2 Suspend all piping in Mechanical Rooms on Type SPH or SPNH isolators as required. Where piping is supported from the floor, weld brackets to the piping and support on Type SPNM isolators. Isolators do not replace constant support hangers or mounts.

.3 The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.

.4 Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-M, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

.2 Ontario Building Code 2012 (OBC)

1.3 DEFINITIONS

.1 For purposes of this Section:

.1 "CONCEALED" means mechanical services and equipment in suspended ceilings, non-accessible chases, and furred-in spaces.

.2 "EXPOSED" means "not concealed" as defined in this Section.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 Provide manufacturer product literature identifying size, type, material and colour of labels.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 PIPE IDENTIFICATION

.1 Mechanical Contractor shall identify piping and equipment throughout with labels and direction of flow arrows regardless of whether or not specified elsewhere. Labelling shall be as per Painting Schedule or as requested by Consultant if not covered in Schedule.

.2 **Pipe Markers and Direction Arrows:** This piping identification system lends itself to commercially available pipe markers having standard sizes of lettering and colours. Standard Colours designate classes of materials as follows, and are consistent with those specified by CAN/CGSB-24.

Colour	Material
Yellow	Dangerous Materials
Green	Safe Materials

Red	Fire Protection Equipment
Blue	Protective Materials

.3 Standard Pipe Identification:

.1 For pipe up to and including 150 mm (6") diameter markers shall consist of coloured, coiled, semi-rigid vinyl plastic of a length to wrap completely around the pipe, and indoor/outdoor type vinyl ink lettering and directional arrows.

.2 Stencilled lettering (black Franklin Gothic) identification and directional arrows for normal flow shall be applied by each colour band.

.3 The lettering and arrow size shall be as indicated below:

Pipe Size (mm)	**Letter Height (mm)**	**Arrow Height x Arrow Length (mm x mm)**
Greater than 65	50	50 x 150
30 to 65	25	25 x 100
Smaller than 30	12	12 x 50

.4 Pipe markers and direction arrows shall be suitable for continuous operating temperatures between -40°and 122°C.

.4 **Standard Pipe Identification Wording and Colours:** Identification wording and colours for pipe identification materials shall be as follows:

Legend	**Colour**	**Symbol**
Potable Cold Water	White/Green	DCW
Potable Hot Water	White/Green	DHW
Potable Hot Water Return	White/Green	DHWR
Tempered Potable Water	White/Green	TW
Storm Drainage	White/Green	ST
Sanitary Drainage	White/Green	SAN
Plumbing Vent	White/Green	VENT
Glycol Heating Water Supply	Black/Yellow	GHWS
Glycol Heating Water Return	Black/Yellow	GHWR

.5 **Identification Material Manufacturers:** Acceptable manufacturers of identification materials shall be equivalent SMS “Coil-Mark” pipe markers:

.1 Smillie McAdams Summerlin Ltd.

.2 W.M. Brady of Canada Ltd.

.3 Revere-Seton Inc.

.4 Embree Industries Ltd.Execution

2.2 EQUIPMENT IDENTIFICATION

.1 **Equipment Nameplates:** Minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, white background – black lettering, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2 ½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Each nameplate shall be complete with bevelled edges and engraved wording to completely identify the equipment with no abbreviations. Wording shall generally be in accordance with the Drawings but must be reviewed by

the Consultant prior to engraving. Supply stainless steel screws for securing nameplates in place.

.2 **Valve Tags:** Coloured, 40 mm (1½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match the piping classification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording. For example:

VALVE V12
200 mm
DCW
NORMALLY OPEN

2.3 DUCT IDENTIFICATION:

.1 Custom made Mylar stencils with 50 mm (2") high lettering to accurately describe the duct service, i.e. “AHU-1 SUPPLY”, complete with a directional arrow, and coloured inks with ink pads and roller applicators. Ink colours shall contrast with the lettering background.

.2 Paint: CAN/CGSB-1.60-M in colours specified in the Contract Documents. Non-specified colours to conform to CAN/CGSB-24.3.

.3 Letters shall be 50 mm high and directional flow arrows shall be 150 mm long stenciled with specified paint with the following wording:

.1 SUPPLY AIR

.2 RETURN AIR

.3 EXHAUST AIR

.4 TRANSFER AIR

3 Execution

3.1 INSTALLATION OF MECHANICAL IDENTIFICATION

.1 **Exposed Piping and Ductwork:** Identify exposed piping and ductwork in accordance with Part 2 of this Section in the following locations:

.1 At every end of every piping or duct run.

.2 Adjacent to each valve, strainer, damper and similar accessory.

.3 At each piece of connecting equipment.

.4 At every change of direction.

.5 On both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified in the Contract Documents.

.6 At 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length.

.7 On each side of special valves, special fittings and branch connections.

.8 At least once in each room and at least once on pipe and duct runs less than 6 m (20') in length.

.2 **Concealed Piping and Ductwork:** Identify concealed piping and ductwork in accordance with Part 2 of this Section in the following locations:

.1 At points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas.

.2 At maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room.

.3 At each access door location.

.4 At each piece of connected equipment, automatic valve, etc.

.3 **Equipment:** Provide an identification nameplate for each piece of equipment, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate all nameplates in the most conspicuous and readable location.

.4 **Electrical Tracing:** For all electrically traced mechanical Work, identification wording shall include the phrase “ELECTRICALLY TRACED”.

.5 **Valve Tagging and Chart:** Tag valves and prepare a valve tag chart in accordance with the following requirements:

.1 Attach a valve tag to each new valve, except for valves located immediately at the equipment they control.

.2 Prepare a typed or computer printed valve tag chart to list all tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed).

.3 Frame and glaze one copy of the chart and affix the same to a wall where later directed at the site.

.4 Include a copy of the valve tag chart in each copy of the O&M instructions.

.6 **Ceiling Tacks or Stickers:** Where shut-off valves, control dampers, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in the ceiling panel material, or stickers on the ceiling grid material to indicate locations of the items. Confirm colours prior to installation.

END OF SECTION

1 General

1.1 SUMMARY

.1 TAB means testing, adjusting and balancing equipment to ensure performance in accordance with requirements of Contract Documents and to perform all other work as specified in this section.

.2 Standard: TAB shall be performed in accordance with the most stringent of TAB standards of AABC, NEBB, SMACNA and ASHRAE.

.3 Perform TAB of all systems, equipment, components, controls specified in the Mechanical Division.

.4 TAB is to be split into two sections of work, the Mechanical Contractors testing and balancing, and the and the TAB Contractor's (see Article 1.3) testing and balancing:.

.1 Mechanical Contractor's Obligations: Leakage testing of piping, and ductwork.

.2 TAB Contractor's Obligations: Testing, adjusting and balancing of all equipment and system components (pumps, valves, fans, dampers, etc).

1.2 THE TAB CONTRACTOR

.1 The Mechanical Contractor in consultation with the Consultant shall appoint a TAB Contractor to measure and report TAB results to the Consultant. The Mechanical Contractor shall submit a proposal to the Consultant for assessment before any selection of the TAB Contractor is made. The proposal shall include:

.1 Experience in projects of this size.

.2 Labour costs per hour plus a maximum upset limit.

.3 Personnel to be used.

.4 Equipment to be used for the testing and balancing of the systems.

.5 Test procedures and methods.

.6 Any other items requested.

.2 Names of all personnel proposed to perform TAB shall be submitted to and approved by the Owner within 90 days of the award of the contract.

.3 Qualifications: Personnel performing TAB shall be current member in good standing of AABC, NEBB, or NBCTA.

.4 Suggested Testing and Balancing Agents: Design Test & Balancing Co. (905-886-6513), John Price Enterprises (416-755-4676), Airwaso (519-652-4040), Technical Aire Balancing Inc (416-492-9408), Air Adjustments & Balancing Inc. (416-254-3004) and Flowset Balancing Ltd. (416-410-9793).

1.3 SUBMITTALS

.1 Pre-mobilization

.1 Submit to the Consultant, prior to the commencement of TAB, the following:

.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

.2 Proposed check lists and report forms.

.2 Preliminary TAB Report

.1 Submit for checking and approval of the Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include the following:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

.3 Tab Report

.1 TAB report shall show all results in SI units and shall include:

.1 Tabulated data from air and piping system measurements; see Article 3.5 and 3.6.

.2 Project record drawings used to show testing locations.

.3 System schematics.

.2 Submit electronic copy of the initial TAB Report to the Consultant for verification and approval, if requested submit one paper copy complete with index tabs.

.3 Provide three copies of the final TAB report. Reports shall be complete with index pages and index tabs, and certified by the TAB Contractor. Any diagram as single line representation of a Mechanical System specifically prepared for this project shall be prepared using a CAD system and shall be acceptable to the consultant.

1.4 QUALITY ASSURANCE

.1 The work specified in this section shall be performed by an Independent Agency specializing in this type of work.

.2 Balancing (of both air and piping systems) and sound level readings shall be performed by the same agency.

.3 Balancing procedures shall be in accordance with the latest, current requirements of “National Environmental Balancing Bureau” (NEBB) or “Associated Air Balance Council” (AABC), including the following:

.1 NEBB Procedural Standards For Whole Building Systems Commissioning Of New Construction;

.2 NEBB Procedural Standards For Testing Adjusting And Balancing Of Environmental Systems;

.3 NEBB Procedural Standards For Retro- Commissioning Of Existing Buildings;

.4 AABC National Standards for Total System Balance;

.5 AABC Test and Balance Procedures;

.4 TAB of systems and equipment regulated by codes, standards shall be to the satisfaction of the Ontario Building Code.

1.5 SCOPE OF TAB

.1 The following systems shall be tested, adjusted, and balanced:

.1 Air conditioning, ventilation and heating systems

.2 Air distribution (supply, return and exhaust)

.3 Miscellaneous ventilation or exhaust systems

.4 Computer Room A/C units

.5 Chillers and chilled water distribution (includes glycol system)

.6 Boilers and heating water distribution (includes glycol system)

.7 Plumbing systems

.8 All process piping including natural gas, oil, compressed air, etc.

2 PRODUCTS [NOT USED]

3 EXECUTION

3.1 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

.4 Report all values back to Consultant.

3.2 COORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into the Work construction and completion schedule so as to ensure completion prior to the acceptance of project.

.2 Perform TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

.3 The TAB Contractor shall co-ordinate with the Mechanical Contractor to ensure that all necessary control and balancing valves (water-side) as well as manual and splitter dampers (air-side) for balancing are installed in all locations required. Notify the Consultant in writing that this co-ordination has taken place. Include in this letter any recommendations made regarding valves, dampers, locations, installation, etc. If this TAB Contractor fails to co-ordinate with the Contractor and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the TAB Contractor at no cost to the Owners.

.4 The TAB Contractor shall not disconnect any control device. Command control devices and enter adjusted set points into the building automation system with tools and training that are furnished under Section 25 00 00 – Building Automation System (BAS). If the TAB Contractor fails to co-ordinate with Section 25 00 00 – Building Automation System (BAS) and if failure to co-ordinate results in any cost, the cost of any change required shall be paid by the TAB Contractor at no cost to the Owner.

.5 The Mechanical Contractor will provide new filters, etc. required for the measurements taken by the TAB Contractor.

.6 The Mechanical Contractor shall provide copies of all Shop Drawings requested by the TAB Contractor.

.7 The Mechanical Contractor shall make staff available, as required by the TAB Contractor, to operate the equipment to take measurements and to correct any deficiencies in the mechanical systems which prevent the TAB Contractor from balancing the system.

3.3 THE MECHANICAL CONTRACTOR'S TESTING

.1 Pipework and ductwork leakage tests shall be carried out on sections of the work during construction and these sections shall be identified by reference number of the test sheet and by description of the piping or duct system. The reference identification number shall be indicated on the As-Built Drawings.

.2 All tests for systems shall be performed in the presence of, and test reports signed by the TAB Contractor. Notify the TAB Contractor in writing a minimum of one week in advance of testing.

.3 Repair any leaks or defects and repeat the tests to the satisfaction of the Consultant.

.4 Ensure access is provided to all valves, dampers, fire dampers, and other equipment that requires servicing.

.5 Start-Up and Operation of Equipment:

.1 Follow start-up procedures as recommended by the equipment manufacturer unless specified otherwise in the Contract Documents.

.2 Follow special start-up procedures specified in the Mechanical Division

.3 Operate systems for length of time required for TAB and as required by the Consultant for verification of TAB reports.

.4 Coordinate with Commissioning Agent as required.

.6 Piping System Tests:

.1 Test all piping systems for leakage in accordance with all applicable plumbing codes.

.2 All other systems not covered by codes noted above shall be tested and proven tight over a period of 24 hours by a hydrostatic test. Remove vents and gauges and temporarily plug connections.

.3 Test pressure for domestic water, and hydronic systems shall be:

.1 1-1/2 times the system working pressure but not less than 1035 kPa (150 psig), or

.2 The maximum working pressure of expansion joints and vibration isolators.

.4 Test pressure for drainage and venting systems:

.1 Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of two hours.

.2 After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship.

.3 Make a smoke test, ball test, or video inspection if required by the local Municipality.

.7 Air System Tests:

.1 Test all ductwork for leakage in accordance with all SMACNA Manuals and Standards.

.2 Seal ducts at all equipment connections and pressurize with a small blower.

.3 Refer to Section 23 00 00 – HVAC Ducts and Plenums, Article 3.2.16 for leakage testing requirements and pressure ratings of ductwork.

.4 The entire system shall be tested for noise, tightness of joints and proper functioning of the system. Noise tests shall be made under minimum system pressure drop

conditions (highest air velocities and clean filter conditions). This Section shall make all necessary alterations and repeat the tests until satisfactory operation is achieved.

3.4 THE TAB CONTRACTOR'S TESTING AND BALANCING

.1 The TAB Contractor is responsible for balancing the systems to obtain the design conditions and shall repeat the balancing until the required conditions have been met.

.2 The TAB Contractor shall balance all air systems to ensure all fans, VAVs, FCUs, and AHUs are operating to design conditions. Adjust air volumes and control settings under maximum system pressure drop conditions by means of balancing dampers and record balance position.

.3 The TAB Contractor shall balance all piping systems to ensure all boilers, chillers, pumps, heat exchangers, AHUs, FCUs, cabinet/unit/other heaters, domestic hot water balancing valves, etc, are operating to design conditions. Adjust the circuits by means of the balancing valves and record balance position.

.4 Pre-Tab Review:

.1 Review contract documents prior to the commencement of the Work and confirm in writing to the Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 If testing procedures are to deviate from the specified standards provide the Consultant with all proposed procedures for acceptance.

.3 During construction, co-ordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

.5 Instruments:

.1 Prior to TAB work, submit to the Consultant a list of instruments to be used for TAB together with serial numbers.

.2 Calibrate the instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate the instruments within 3 months of the performance of TAB work. Provide certification of calibration to the Consultant.

.6 Tolerances:

.1 Perform TAB in accordance with the following application tolerances of design information:

.1 Piping systems: Plus or minus 10%.

.2 Air systems: Plus or minus 5%.

.2 Accuracy of measured values shall be accurate to within plus or minus 2% of actual values.

.7 Start-up of TAB:

.1 Notify the Commissioning Agent and the Consultant seven (7) days prior to start of TAB.

.2 Start TAB only when the building is essentially completed, including the following components:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather stripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere; Division 22, 23, 25.

.4 All provisions and components for TAB installed and operational.

.5 Start-up and verification of proper, normal and safe operation of all mechanical systems and associated electrical/control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Duct access doors installed, closed.

.8 All outlets installed, volume control dampers open.

.3 Piping systems:

.1 Flushed, filled and vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolation, check, and control valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

.3 The TAB Contractor shall balance the air and piping systems as described in Articles 3.5 and 3.6 of this Section. TAB Contractor shall submit an initial TAB Report for Verification.

.8 Verification:

.1 After initial balancing all reported results are subject to verification by the Consultant.

.2 In all cases where measurements by the TAB Contractor show failure to comply with the Drawings and Specifications, the Contractor shall change fan sheaves, etc., as required, and new balancing measurements shall be made by the TAB Contractor.

.3 At the time of final review, recheck in the presence of the Consultant random selections of air quantities and fan data recorded in the certified report. Points or areas for recheck shall be selected by the Consultant and be approximately 10% of the report data.

.4 At the time of verification measure space temperature and humidity in a representative number of rooms to verify performance. Tabulate these results and bind into certified report as an appendix.

.5 Number and location of verified results shall be at the discretion of the Consultant. A measured flow deviation of more than 10% between the verification reading and the reported data shall be considered as failing the verification procedure.

.6 Bear costs to repeat TAB and submit new certified reports as required to the satisfaction of the Consultant.

.9 Completion of TAB:

.1 TAB shall be considered complete when the final TAB Report is received and approved by the Consultant.

.2 After TAB is competed to satisfaction of the Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.3 Following final acceptance of the certified reports by the Consultant, permanently mark the settings of all valves, dampers, splitters and other adjustable devices so that balance set position can be restored if disturbed at any time. Do not mark such devices until after final acceptance.

.4 Ensure all thermostats and controls are set to give specified conditions and include settings is report.

3.5 AIR SYSTEMS TESTING BY TAB CONTRACTOR

.1 Measurements: shall include, but not be limited to the following as appropriate for systems, equipment, components, controls:

.1 Air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements shall include, but not be limited to the following as appropriate:

.1 Inlet and outlet of each damper, filter, coil, humidifier, fan, other equipment causing changes in conditions, at each controller, controlled devices.

.3 Locations of systems measurements shall include, but not be limited to following as appropriate:

.1 Each main duct, main branch, sub-branch, or run-out (or grille, register or diffuser).

.4 Duct traverse readings shall be taken through the access ports provided. Where no access ports have been provided new holes shall be made as required. These holes shall be resealed after final readings with sheet metal cover plates and sealant. Duct tape is not acceptable. Where insulation is damaged it shall be repaired including the vapour barrier in an approved manner. Duct tape is not acceptable.

.5 Fans on all systems shall be set up to give the minimum discharge pressure required to overcome the resistance of the box, discharge ductwork and diffusers.

3.6 PIPING SYSTEMS TESTING BY TAB CONTRACTOR

.1 Measurements: shall include, but not be limited to the following as appropriate for systems, equipment, components, controls:

.1 Liquid velocity, pressure, flow rate, pressure drop (or loss), temperatures, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements shall include, but not be limited to following as appropriate:

.1 Inlet and outlet of each heater, tank, pump, circulator, at each controller, controlled device, or fixture. (Includes both hydronic and plumbing systems)

.3 Locations of systems measurements shall include, but not be limited to following as appropriate:

.1 Each main, main branch, branch, or sub-branch.

.4 Flow through all coils, heat exchangers, chillers, boilers and other such equipment shall be balanced to ensure that the pressure drop through the equipment is within 10% of the manufacturer's design conditions.

.5 If the design conditions cannot be met by adjusting the balancing valves throughout the system, or by the adjusted the VFD settings, then pump impellers shall be either changed or trimmed as required.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section covers the selection and installation of plumbing, process, and building mechanical piping insulation as well as the selection and installation of ductwork insulation unless additional requirements have been detailed elsewhere in the Contract Documents.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 20 05 29 – Hangers and Supports.

.3 Section 22 11 19 – Domestic Water Piping.

.4 Section 22 11 20 – Drainage, Waste and Venting Piping.

.5 Section 23 31 00 – HVAC Ducts and Plenums.

.6 Section 23 57 19 – Hydronic Piping.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

.1 ASTM B 209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulations

.3 ASTM C 177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.4 ASTM C 240, Standard Test Methods of Testing Cellular Glass Insulation Block.

.5 ASTM C 335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.6 ASTM C 411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.7 ASTM C 449, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.8 ASTM C 547, Specification for Mineral Fiber Pipe Insulation.

.9 ASTM C 553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.10 ASTM C 612, Specification for Mineral Fiber Block and Board Thermal Insulation.

.11 ASTM C 795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.12 ASTM C 921, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.13 ASTM E 96 / E 96M, Standard Test Methods for Water Vapor Transmission of Materials.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 International Organization for Standardization (ISO)

.1 ISO-6944, Duct 'A' Standard with 1 or 2-Hour External Duct Fire Rating.

.5 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.7 Ontario Building Code 2012 (OBC)

1.4 DEFINITIONS

.1 For purposes of this Section:

.1 "CONCEALED" means insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" means "not concealed" as defined in this Section.

.3 Insulation systems shall mean insulation material, fasteners, jackets, and other accessories.

1.5 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Requirements.

.2 Shop Drawings:

.1 Submit a set of shop drawings identifying each product with the manufacturer's name and insulation type, and the proposed use of the insulation. Include a product data sheet for each insulation type.

.2 Include shop drawings of all insulation jacket materials, each identified as to its intended use, and product data sheets for the protective coatings.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 FIRE HAZARD RATINGS

.1 All insulation materials shall meet the requirements of CAN/ULC-S700 Series Standards.

.2 Unless otherwise specified in the Contract Documents, all insulation system materials inside the building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102.

2.2 PIPE INSULATION MATERIALS

.1 **Flexible Elastomeric Foam:** Closed cell, tubular foamed plastic pipe insulation with a "k" factor of 0.039 W/m°C (0.27 BTU/hr*ft*°F) when tested in accordance with ASTM C177 or ASTM C518 at mean temperature 24°C (75°F), 25/50 flame spread/smoke developed rated, with a water vapour transmission rating of 0.08 in accordance with ASTM E 96, Procedure A, and all required installation accessories. Acceptable products are:

.1 Armacell LLC "AP Armaflex 25/50" with "Armafix" insulation pipe hangers (IPH)

.2 **Closed Cell Foamed Glass:** Pittsburgh-Corning "FOAMGLASS", expanded, sectional, rigid sleeve type insulation with a liquid or vapour permeability rating (in accordance with ASTM C240) of 0.00, and a factory applied "PITTWRAP SSII" self-sealing jacket secured with, when required. "PITTWRAP SS" primer and PC88 adhesive.

.3 **Preformed Calcium Silicate:** Rigid, sectional sleeve type insulation in accordance with ASTM C533 with a "k" factor of 0.079 W/m°C (0.55 BTU/hr*ft*°F). Acceptable products are:

.1 Johns Manville Inc. "Thermo-12 Gold"

.2 Calsilite Group (Industrial Insulation Group LLC) Ruston "GOLD"

.4 **Fire Rated Preformed Fibreglass:** Non-Combustible, fire rated, hollow cylindrical heavy density (min 7 pcf or 112 kg/m3) fibreglass units with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. Pipe covering material as listed as a firestop component in cUL/ULC listed firestop systems, C-AJ-1366, C-AJ-1066, W-J-1127, C-AJ-5125, and C-AJ-8075.

.5 **Preformed Fibreglass:** Rigid, sectional, sleeve type insulation with a "k" factor of 0.033W/m°C (0.23 @ 75°F) when tested in accordance with ASTM C335 (Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation), and a factory applied vapour retarding jacket (.02 perm). Acceptable products are:

.1 Johns Manville Inc. "Micro-Lok H" with "ASJ-SSL jacket

.2 Knauf Insulation Ltd. Earthwool 1000° with ASJ/SSL Pipe Insulation

.3 Manson Insulation Products Ltd. "ALLEY K" with "ASJ-SSL" jacket

.6 **Blanket Fibreglass:** Blanket type roll insulation, 24 kg/m^3 (1.5 lb/ft^3) density, with installed "R" value of 0.83 m2 °C/W (4.7 BTU/hr*ft*°F, and a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Type 150 "Microlite"

.2 Knauf Insulation Ltd. Fiber Glass Blanket Insulation with multi-purpose "FSK" facing

.3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"

.7 **Phenolic Foam:** Belform Insulation Ltd. (519-652-5190) "Insulphen" rigid, 32 kg/m^3 (2 lb/ft^3) density, closed cell sectional pipe insulation and factory fabricated shapes

for fittings, with a R Value of 7.7 for 25 mm (1 in.) thick insulation and a factory applied FSK vapour barrier jacket.

.8 **Pipe Insulation at Hangers and Supports:** Coordinate with discipline responsible for Section 20 05 29 Hangers and Supports to provide thermal breaks as listed here and in section 2.9 of that specification. Insulation shall be a 300 mm (12 in.) long piece of sectional pipe insulation with a thickness equal to the adjacent insulation, a foil and glass reinforced kraft paper vapour barrier jacket, and a minimum 0.80 mm thick (22 ga) G60 galvanized steel shield the same length as the insulation. The insulation shall be:

.1 Johns Manville Inc. "Thermo-12 Gold" or Calsilite Group Ruston "GOLD" rigid calcium silicate

.2 Belform Insulation Ltd. 60 kg/m^3 (3.75 lb./ft^3) density "Insulphen" closed cell phenolic foam

2.3 WHEELCHAIR LAVATORY PIPING INSULATION KITS

.1 Removable, flexible, reusable, white moulded plastic insulation kits for a wheelchair lavatory drain piping and potable water supplies exposed under the lavatory. Acceptable products are:

.1 Plumberex Specialty Products Inc. "Pro-2000" Series

.2 Truebo Inc. "Handi Lav-Guard"

.3 TCI Products Inc. "SKAL-GARD"

.4 John Manville Inc. Zeston "SNAP-TRAP"

2.4 EQUIPMENT INSULATION MATERIALS

.1 **Blanket Fibreglass:** Blanket type roll form insulation, 24 kg/m^3 (1.5 lb/ft^3) density, with a "k" factor (compressed thickness) of 0.035 W/m°C (0.24 BTU/hr*ft*°F), with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Type 150 "Microlite"

.2 Knauf Insulation Ltd. Friendly Feel Duct Wrap with KwikStretch Markings with multi-purpose "FSK" facing

.3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"

.2 **Semi-Rigid Fibreglass Board:** Roll form, moulded insulation, 48.1 kg/m^3 (3.0 lb/ft^3) density, with a "k" factor of 0.033 W/m°C (0.23 BTU/hr*ft*°F), with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper. Acceptable products are:

.1 Johns Manville Inc. "Pipe and Equipment Insulation"

.2 Knauf Insulation Ltd. Fiber Glass Pipe and Tank Insulation or KwikFlex Pipe & Tank Insulation

.3 Manson Insulation Inc. "AK FLEX"

.3 **Preformed Calcium Silicate:** Rigid block and/or semi-rigid factory scored block insulation. Acceptable products are:

.1 Johns Manville Inc. "Thermo-12 Gold"

.2 Calsilite Group (Industrial Insulation Group LLC) Ruston "GOLD"

.4 **Closed Cell Foamed Glass:** Pittsburgh Corning "FOAMGLAS" expanded, rigid board and bock type insulation with a liquid or vapour permeability rating (in accordance with ASTM C240) of 0.00.

2.5 DUCTWORK SYSTEM INSULATION MATERIALS

.1 **Rigid Fibreglass Board:** Preformed board type insulation, 48.1 kg/m^3 (3.0 lb/ft^3) density, with a "k" factor of 0.033 W/m°C (0.23 BTU/hr*ft*°F @ 75°F mean), with a factory applied reinforced aluminum foil and kraft paper facing. Acceptable products are:

.1 Johns Manville Inc. Type 814 "Spin-Glas"

.2 Knauf Insulation Ltd. Fiber Glass Insulation Board with FSK facing

.3 Manson Insulation Products Ltd. "AK BOARD FSK"

.2 **Blanket Fibreglass:** Blanket type roll form insulation, 24 kg/m^3 (1.5 lb/ft^3) density, 40mm (1.5 in.) thick, with a factory applied vapour barrier facing. Acceptable products are:

.1 Johns Manville Inc. Duct Wrap Type 150 "Microlite"

.2 Knauf Insulation Ltd. Friendly Feel Duct Wrap with KwikStretch Markings with multi-purpose "FSK" facing

.3 Manson Insulation Products Ltd. "ALLEY WRAP FSK"

.3 **Preformed Calcium Silicate:** Rigid block and sheet insulation. Acceptable products are:

.1 Johns Manville Inc. "Thermo-12 Gold"

.2 Calsilite Group (Industrial Insulation Group LLC) Ruston "GOLD"

.4 **Flexible Elastomeric Foam Sheet:** Sheet form, closed cell foamed plastic insulation with a "k" factor of 0.039 W/m°C (0.27 BTU/hr*ft*°F) at mean temp 24°C (75°F) per ASTM C177, 25/50 flame spread/smoke developed rated, with a water vapour transmission rating of 0.08 in accordance with ASTM E 96, Procedure A, and all required installation accessories. Acceptable products are:

.1 Armacell LLC "AP Armaflex 25/50" Sheet & Roll

2.6 INSULATION FASTENINGS

.1 **Wire:** Minimum 1.8 mm diameter (15 ga) galvanized annealed wire.

.2 Stainless Steel Banding: Childers Products Co. "FABSTAPS" 0.6 mm (24 ga) Type 304 minimum 12 mm (0.5 in.) wide stainless steel strapping or approved equivalent.

.3 **Duct Insulation Fasteners:** Weld-on 2 mm (12 ga) zinc coated steel spindles of suitable length, complete with minimum 40 mm (1.5 in.) square plastic or zinc plated steel self-locking washers.

.4 **Tape Sealant:** Venture Tape Corp. 1525CW, 3M FSK Silver (foil) Facing Tape UL 723 classified (5/10 flame/smoke rating), 3M™ FSK Facing Tape or approved equivalent self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match the surface being sealed.

.5 **Adhesive - Fibreglass Insulation:** Clear, pressure sensitive, quick setting brush consistency adhesive, non-flammable when wet, fire resistive when dry, suitable for a temperature range of -20□C (-4°F) to 82□C (180□F) and compatible with the type of material to be secured, and WHMIS classified as non-hazardous.

.6 **Adhesive – Flexible Elastomeric Insulation:** Armstrong World Industries Inc. # 520 air-drying contact adhesive.

.7 **Adhesive – Phenolic foam Insulation:** As recommended by the insulation manufacturer.

.8 **Adhesive – Closed Cell Foamed Glass Insulation:** Pittsburgh-Corning PC88 multi-purpose two-component adhesive.

.9 **Sheet Metal Screws:** No. 10 stainless steel sheet metal screws.

2.7 INSULATION JACKETS AND FINISHES

.1 **White PVC Fitting Covers:** Factory preformed, one-piece, minimum 15 mil thick white PVC covers, 25/50 rated with a semi-luster finish. Acceptable products are:

.1 Proto Corp. "LoSMOKE"

.2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"

.3 Speedline Corporation The Sure-Fit System "SMOKE-LESS 25/50"

.4 Johns Manville Inc. "Zeston"

.5 Belform Insulation Ltd.

.2 **White Sheet PVC:** Roll form (and fitting covers), minimum 15 mil thick white PVC, 25/50 rated, complete with installation and sealing accessories. Acceptable products are:

.1 Proto Corp. "LoSMOKE"

.2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"

.3 Speedline Corporation The Sure-Fit System "SMOKE-LESS 25/50"

.4 Johns Manville Inc. "Zeston"

.5 Belform Insulation Ltd.

.3 **Coloured Sheet PVC:** Roll form (and fitting covers), minimum 15 mil thick coloured PVC, 25/50 rated, complete with insulation and sealing accessories. Acceptable products are:

.1 Proto Corp. "LoSMOKE"

.2 Foster Products (H.B. Fuller Construction Products Inc.) "SMOKE-SAFE 25/50 SEALFAS"

.3 Speedline Corporation The Sure Fit System "SMOKE-LESS 25/50"

.4 Johns Manville Inc. "Zeston"

.5 Belform Insulation Ltd.

.4 **Aluminum:** Smooth aluminum jacket material with a 13 mm (0.5 in.) safety edge in accordance with ASTM B209, 0.6 mm (0.025 in.) thick, factory cut to size and complete with moisture barrier and 50 mm overlap and with stainless steel bands on 300 mm (12 in.) centres. Fittings shall be two piece epoxy coated with silicone joints as required.

.5 **Stainless Steel:** Smooth type 304 stainless steel jacket material to ASTM A240, 0.4mm (0.016 in.) thick, factory cut to size, complete with moisture barrier and 50 mm

overlap and with stainless steel bands on 300 mm (12 in.) centers. Fittings are to be two piece pressed stainless steel with with silicone joints as required.

.6 **Adhesive Backed Metal Faced Weather Barrier:** Belform Insulation Ltd. "Flex-Clad 400" roll form sheet material with an adhesive backing and an embossed aluminum facing.

.7 **Factory Applied Insulation Weather Barrier:** Knauf Insulation Ltd. Redi-Klad™ 1,000° pipe insulation, factory applied, five-ply, weather and abuse resistant, 0.0 permeability, embossed aluminum, self-sealing lap pipe insulation jacket. Insulation and jacketing system shall be designed for piping systems operating from -18°C to 538°C (0°F to 1,000°F).

.8 **Insulation Cement:** Heat resistant, trowel consistency thermal insulating and finishing cement to ASTM C-449/C-449M, and suitable in all respects for the application.

.9 **Protective Coating - Foamed Glass Insulation:** Pittsburgh Corning Co. "PITTCOTE 404" flexible acrylic latex weather barrier coating, white unless otherwise specified in the Contract.

.10 **Protective Coating - Flexible Elastomeric Foam Insulation:** Armacell LLC "WB Armaflex" white, water based latex enamel, semi-gloss or approved equivalent.

3 Execution

3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

.1 Unless otherwise specified in the Contract Documents, do not insulate the following:

.1 Factory insulated equipment and piping;

.2 Heating piping within radiation unit enclosures, including blank filler sections of enclosures;

.3 Heating piping in soffits and/or overhang spaces and connected to bare element radiation in the spaces;

.4 Branch potable water piping located under counters to serve counter mounted plumbing fixtures and fittings, except wheelchair lavatories;

.5 Exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings, except wheelchair lavatories;

.6 Heated liquid system pump casings, valves, strainers and similar accessories;

.7 Manufactured expansion joints and flexible connections;

.8 Acoustically lined ductwork and/or equipment; and

.9 Flexible ductwork.

.2 Unless otherwise specified or shown in the Contract Documents the installation of piping and ductwork insulation shall be in accordance with the TIAC Mechanical Insulation Best Practices Guide.

.3 Install insulation directly over pipes and ducts and not over hangers and supports. Insulation and covering shall pass unbroken through the hangers and supports.

.4 Do not apply insulation unless leakage tests have been satisfactorily completed.

.5 Ensure that all surfaces to be insulated are clean and dry.

.6 Ensure that the ambient temperature is minimum 13ºC (55ºF) for a minimum of one day prior to the application of insulation, and for the duration of insulation work, and that relative humidity is and will be at a level such that mildew will not form on insulation materials.

.7 Install piping insulation and covering continuous through pipe openings and sleeves.

.8 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.9 Pipe insulation at hangers and supports shall consist of a minimum of 300 mm (12 in.) long sections of calcium silicate or phenolic foam sectional insulation with vapour barrier jacket. Coordinate with discipline responsible for Section 20 05 29 Hangers and Supports to provide thermal breaks as listed here and in section 2.9 of that specification. Galvanized steel shields shall be provided between the insulation and the hanger or support for all pipe 50 mm (2 in.) diameter and above and not requiring a roller hanger or support. Provide "Armafix" insulation pipe hangers (IPH) for flexible elastomeric foam insulation.

.10 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal. Insulation on cold piping must not be broken. Saddles that touch the cold piping directly are not acceptable on cold piping.

.11 Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.

.12 The final appearance and finish of exposed mechanical Work depends to a large degree on the quality of the insulation application, therefore, a neat and properly finished insulation job will be insisted upon.

.13 When insulating vertical piping risers 75 mm (3 in.) diameter and larger, use insulation support rings welded directly above the lowest pipe fitting, and thereafter at 4.5 m (15 ft.) centres and at each valve and flange. Insulate in accordance with Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.14 Where piping and/or equipment is traced with electric heating cable, ensure that the cable has been tested and accepted prior to the application of insulation, and ensure that the cable is not damaged or displaced during the application of insulation.

.15 Where existing insulation work is damaged as a result of a new mechanical work, repair the damaged insulation work to new work standards.

.16 Where fibreglass rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover the exposed end of the insulation with a purpose made PVC cover on "cold" piping.

.17 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.

.18 Where thermometers, gauges, etc., occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a

neat, properly sized hole in the insulation and provide a suitable grommet in the opening.

3.2 PIPE INSULATION REQUIREMENTS – FIBREGLASS

.1 **Domestic Water:** Insulate the following pipe with fibreglass insulation of the thickness noted below:

.1 Potable cold water piping inside building and above ground – 25 mm (1 in.) thick.

.2 Potable hot water piping within. operating water temperatures up to and including 60°C (140°F), size of up to and including 32 mm (1.25 in.) – 25 mm (1 in.) thick.

.3 Tempered potable water piping, up to and including 32 mm (1.5 in.) - 25 mm (1 in.) thick.

.4 Tempered potable water piping, 40 mm (1.5 in.) and larger - 40 mm (1.5 in.) thick.

.5 Potable hot water recirculation piping with operating water temperatures up to and including 60°C (140°F), size of up to and including 32 mm (1.25 in.) - 25 mm (1 in.) thick.

.6 Non-potable cold water inside building and above ground – 25 mm (1 in.) thick.

.2 **Drainage, Waste, and Venting:** Insulate the following pipe with fibreglass insulation of the thickness noted below:

.1 Storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal mains. Where the roof drain is less than 3000 mm (10 ft.) from the vertical leader, insulate the first 3000 mm (10 ft.) of pipe closest to the roof drain including the vertical riser - 25 mm (1 in.) thick.

.2 Drainage piping from refrigerated drinking fountains to nearest 75 mm (3 in.) dia. or larger drain pipe – 25 mm (1 in.) thick.

.3 Drainage piping carrying chilled condensate to closest branch or main – 25

.3 **Heating Water Piping:** Insulate the following pipe with fibreglass insulation of the thickness noted below:

.4 Glycol solution heating or heat reclaim piping, supply and return, up to and including 32 mm (1.25 in.) dia. - 40 mm (1.5 in.) thick.

.5 Glycol solution heating or heat reclaim piping, supply and return, 40 mm (1.5 in.) dia. and larger - 50 mm (2 in.) thick.

.6 Piping: Ensure that the overlap flap of the sectional insulation jacket is secured tightly in place. Cover section to section butt joints with tape sealant.

.7 Fittings: Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket fibreglass insulation to a thickness and insulating value equal to the sectional insulation and secured in place with adhesive and/or wire and covered with PVC fitting covers. Provide sufficient material to prevent the PVC cover from being pushed in or crushed.

.8 "Cold" Piping Valves, Strainers, Etc.: Insulate valves, strainers, and similar piping system accessories in "cold" piping such as potable water piping with cut and tightly fitted segments of sectional pipe insulation with all joints covered with tape sealant,

or, alternatively, wrap the piping valve, strainer, etc., with blanket fibreglass and cover with PVC covers as for "Fittings" above.

.9 Flanges and Mechanical Couplings: Terminate sectional insulation approximately 50 mm from the flange or coupling on each side of the flange or coupling. Cover the flange or coupling with a minimum 50 mm (2 in.) thickness of blanket fibreglass insulation wide enough to butt tightly to the ends of the adjacent sectional insulation. Secure the blanket insulation in place and cover with a PVC cover. Provide sufficient material to prevent the PVC cover from being pushed in or crushed.

.10 Concealed Rough-In piping at Plumbing Fixtures: Take special care at concealed potable water rough-in piping at plumbing fixtures to ensure that the piping is properly insulated. If necessary due to space limitations, use 12 mm (0.5 in.) thick sectional pipe insulation in lieu of 25 mm (1 in.) thick insulation.

.11 Alternative Phenolic Foam Insulation: Phenolic foam insulation with a thickness to give an equivalent insulating value to that of the fibreglass insulation and secured in place and sealed in accordance with the manufacturer's recommendations is acceptable in lieu of fibreglass insulation.

3.3 INSTALLATION OF WHEELCHAIR LAVATORY INSULATION KITS

.1 Provide manufactured insulation kits to cover exposed drainage and water piping under new wheelchair lavatories.

3.4 DUCTWORK INSULATION REQUIREMENTS – FIBREGLASS

.1 Insulate the following ductwork systems with fibreglass insulation of the thickness noted below:

.1 All fresh air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to the first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and the fresh air is not tempered, then the fresh air ductwork system complete – 50 mm (2 in.) thick

.2 Mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket

.3 Supply air ductwork outward from fans, except for supply ductwork exposed in the area it serves – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket

.4 Exhaust discharge ductwork for a distance of 3 m (10 ft.) downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10 ft.) distance or up until the motor operated damper – 50 mm (2 in.) thick rigid board or 40 mm (1.5 in.) thick flexible blanket

.5 Any other ductwork, casings, plenums or sections specified or detailed on the Drawings to be insulated – thickness shall be as specified on the Drawings.

.2 Insulation for casings, plenums, exposed rectangular ductwork shall be rigid board type. Insulation for round ductwork and concealed rectangular ductwork shall be blanket type.

.3 Liberally apply adhesive to all surfaces of the ductwork and/or casing. Provide weld-on pins at 450 mm (18 in.) centres on the bottom duct surface only where blanket insulation is to be applied, and at 450 mm (18 in.) centres on bottom and side surfaces of ducts and/or casings where board insulation is to be applied. Secure the insulation in place with tight circumferential and longitudinal joints. Secure and seal

all joints with 75 mm (3 in.) wide tape sealant. Install self-locking washers over pins and cut-off any excess pin length. Ensure that the insulation does not sag or bulge.

.4 Provide drywall type metal corner beads on edges of exposed rectangular ductwork, casings and plenums in equipment rooms, service corridors, and any other area where the insulation is subject to accidental damage. Secure in place with tape sealant.

.5 At each trapeze type duct hanger under rectangular or oval ductwork to be insulated with blanket type insulation, provide a 100 mm (4 in.) wide full length piece of rigid fibreglass board insulation between the duct and the hanger and cover joints with strips of tape sealant.

.6 At each band type duct hanger around round ductwork to be insulated, provided a 100 mm (4 in.) wide section of sleeve or scored board type fibreglass insulation and cover joints with tape sealant.

3.5 INSULATION FINISH REQUIREMENTS

.1 White Sheet PVC: Unless otherwise shown and/or specified in the Contract Documents, jacket all exposed fibreglass insulation work inside the building with white sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal all joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by the manufacturer's instructions.

.1 Ductwork.

.2 Piping not listed under “Coloured Sheet PVC”.

.2 Coloured Sheet PVC: Unless otherwise shown and/or specified in the Contract Documents, jacket all exposed fibreglass insulation work inside the building with coloured sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal all joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by the manufacturer's instructions. Provide coloured sheet PVC and PVC fitting covers for the following insulation:

.1 Potable Water – Blue

.2 Non-Potable Water – Light Blue

.3 Tempered Potable Water – Blue

.4 Domestic Hot Water – Blue

.5 Storm Water – Grey

.6 Glycol Hot Water Heating – Yellow

.3 Protective Coating - Foamed Glass Insulation: Apply two heavy coats of "PITTCOTE 404" coating to all foamed glass insulation exposed above grade.

.4 Protective Coating – Flexible Elastomeric Insulation: Apply two heavy coats of the coating specified in the Contract Documents to all flexible elastomeric insulation exposed above grade.

END OF SECTION

1 General

.1 Cleaning of new potable water piping system prior to commissioning and handover of the system.

2 Products

2.1 CHLORINE

.1 Javex Manufacturing Canada “JAVEX-12” or approved equivalent sodium hypochlorite to AWWA B-300-75.

3 Execution

3.1 FLUSHING AND DISINFECTING PIPING:

.1 Flush and disinfect potable water piping after leakage testing is complete.

.2 Flush piping with a sufficient flow of potable water to produce a velocity of 1.5 mps (5 fps) for 10 minutes, or until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

.3 Dissolve chlorinous compounds such as “pittchlor” or “hth” in water to produce a solution.

.4 Introduce the solution at one end of the system being sterilized until water taken off at the remote end(s) test at a level of 50 mg/litre.

.5 Allow the chlorinous solution to remain in the piping for 24 hours. Take further samples and test them to ensure there are not less than 25 mg/litre of chlorine residual throughout the system. If less than 25 mg/litre of chlorine residual exist in the system after 24 hours reflush the entire system and repeat the sterilization procedure. Do not place piping into service until bacteriological tests indicate zero coliform count.

.6 Provide copies of test results.

.7 When disinfecting is complete, fill the systems.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 11 19 – Domestic Water Piping Specialties.

.3 Section 22 11 20 – Domestic Water Expansion Tanks.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.2 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.3 ASTM B88, Standard Specification for Seamless Copper Water Tube.

.4 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.5 ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.6 ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.

.7 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

.2 American Water Works Association (AWWA)

.1 AWWA B-300, Hypochlorites.

.2 AWWA, C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B64, Backflow Preventers and Vacuum Breakers

.2 CAN/CSA B137.2: Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications.

.3 CAN/CSA B137.3: Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications

.4 CAN/ CSA B356: Water Pressure Reducing Valves for Domestic Water Supply Systems

.5 ASME A112.18.1/CSA B125.1-2012,Plumbing Supply Fittings

.6 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

.7 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems

.4 National Sanitation Foundation (NSF International)

.1 NSF/ANSI 14, Plastics Piping System Components and Related Materials.

.2 NSF/ANSI 61, Drinking Water System Components – Health Effects.

.5 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Product Data:

.1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHIMS MSDS – Materials Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

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

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 PIPING AND FITTINGS

.1 **Type “K” Soft Copper:** Type “K” soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

.2 **Copper - Solder Joint:** Type “L” hard drawn seamless copper to ASTM B88, complete with wrought copper solder joint pressure fittings, ANSI/ASME B16.22 or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18. Soldered joints made using 96-0.5-4 tin silver copper, 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, conforming to ASTM B32.

.3 **Copper – Press Joint:** Type “L” hard drawn seamless copper to ASTM B88, complete with wrought copper press fittings (ANSI/ASME B16.22) or cast copper alloy press fittings (ANSI/ASME B16.18) conforming to the performance criteria of IAPMO PS 117. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. System to be listed to NSF/ANSI 61 and to be rated to a minimum of 200 psi.

.1 Acceptable Manufacturers

.1 Viega Llc. “ProPress”

.2 Nibco Inc. “Press Fittings”

.4 **Copper - Grooved Joint:** Type “L” hard drawn seamless copper to ASTM B88, complete with shop or site roll grooved ends. Grooved end fittings conforming to ASTM B75. Couplings to be designed with angle bolt pads to provide a rigid joint, sealed with an EPDM gasket suitable for potable water service. Gaskets rated for temperatures from -35°C to 121 °C (-30°F to 250°F). System to be listed to NSF/ANSI 61.

.1 Acceptable Manufactures

.1 Victaulic “Copper Connection” Style 606 of Style 607

.2 Gruvlok “RIGIDLITE” Fig. 7400

.3 Tyco Grinnell 672

.4 Shurjoint #C301

3 Execution

3.1 PIPING MATERIAL AND JOINT TYPES:

.1 Above grade piping, unless otherwise specified, is to be as follows:

.1 Domestic water, 25 mm (1 in.) and smaller, less than 1380 kPa (200 psi) working pressure:

.1 **Copper - Solder Joint** piping shall be used.

.2 Alternatively **Copper - Press Joint** piping may be used.

.2 Domestic water, larger than 25 mm (1 in.) up to and including 75mm (3 in.), less than 1380 kPa (200 psi) working pressure:

.1 Shall use **Copper - Solder Joint** piping.

.2 Alternatively **Copper - Press Joint** and **Copper – Grooved Joint** piping may be used.

3.2 GENERAL PIPING INSTALLATION REQUIREMENTS

.1 Provide all required potable water piping.

.2 Slope all piping so that it can be completely drained

.3 Unless otherwise specified in the Contract Documents, locate and arrange horizontal pipes above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.

.4 Unless otherwise specified in the Contract Documents, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.

.5 Install all pipes and ducts parallel to building lines (all piping shall run parallel with closest wall).

.6 Piping in walk-in pipe spaces shall be installed as close to one wall as possible.

.7 Neatly group and arrange all exposed Work.

.8 Locate all valves and any other equipment which will or may need maintenance or repaired in accessible spaces, equipment shall be easily accessible from access doors. Where valves and similar piping accessories occur in vertical service spaces (ie. in shafts, pipe spaces or partitions) locate the accessories at the floor level.

.9 Make all connections between pipes of different materials using proper approved adapters. Provide proper dielectric unions in all connections between copper pipe and ferrous pipe or equipment. Dielectric fitting to conform to ASTM F492 complete with thermoplastic liner.

.10 Ensure that the equipment and material manufacturers' installation instructions are followed unless otherwise specified in this Section or on the Drawings, and unless such instructions contradict governing codes and regulations.

.11 Carefully clean all pipes and fittings prior to installation. Temporarily cap or plug ends of pipes and equipment which are open and exposed during construction.

.12 Install piping which is to be insulated so that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the pipe, except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.

.13 Inspect surfaces and structure prepared by other trades before performing the work of this Section. Verify that surfaces or the structure to receive the work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of the work shall constitute the Contractor's acceptance of such surfaces as being satisfactory.

3.3 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream all piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads, unless otherwise specified in the Contract Documents, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two pipe threads are to remain exposed.

.4 Unless otherwise specified in the Contract Documents, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.

.5 Install mechanical joint fittings and couplings in accordance with the manufacturer's instructions.

.6 If grooved fittings and couplings are used, ensure that all valves and piping accessories are suitable. Grooves shall be rolled. Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to the manufacturer's instructions with respect to pipe grooving, support, anchoring and guiding the grooved piping system. Note that all grooved end piping system products shall be supplied by a single manufacturer who is operating to an ISO 9001 program.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 20 05 00 - General Mechanical Requirements.

.2 Test pressure: Shall be the larger value of 150% maximum system operating pressure or 860 kPa.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 11 16 – Domestic Water Piping.

.3 Section 22 11 20 – Domestic Water Expansion Tanks.

.4 Section 22 11 23 – Domestic Water Pumps.

.5 Section 22 31 16 – Water Softening Equipment.

.6 Section 22 34 36 - Domestic Hot Water Heaters and Tanks

1.2 REFERENCES

.1 American Society of Testing and Materials (ASTM)

.1 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.2 American Water Works Association (AWWA)

.1 AWWA C701, Cold Water Meters – Turbine Type

.2 AWWA C702, Cold Water Meters – Compound Type

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B64, Backflow Preventers and Vacuum Breakers

.2 CAN/ CSA B356: Water Pressure Reducing Valves for Domestic Water Supply Systems

.3 ASME A112.18.1/CSA B125.1-2012, Plumbing Supply Fittings

.4 National Sanitation Foundation (NSF International)

.1 NSF/ANSI 61, Drinking Water System Components – Health Effects

.2 NSF/ANSI 371, Drinking Water System Components – Lead Content

.5 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Shop Drawings:

.1 Provide the manufacturer's printed product literature and datasheets for equipment, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 SHUT-OFF VALVES

.1 Ball Valves: Lead Free Class 600, 4140 kPa (600 psi) WOG rated full port ball type valves, each complete with a forged brass or bronze body with solder ends, forged brass cap and blowout-proof stem, solid forged brass chrome plated ball, “Teflon” or “PTFE” seat, and a removable lever handle. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Kitz Corporation Code No. 859.

.2 Toyo Valve Co. Fig. 5049ALF.

.3 MAS B-4LF.

.4 Nibco #S-585-80LF (Bronze).

.5 Watts Water Technologies (Canada), Inc. #LF6080, LFB6081-3C.

.2 Butterfly Valves – Lead Free, Flanged Joint: Non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated butterfly valves, each complete with a coated cast iron or ductile iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for potable water bubble-tight dead end service with the valve in position and either side of the connecting piping removed. Butterfly valves to and including 100 mm (4 inch) diameter are to be equipped with lever handles. Butterfly valves larger than 100 mm (4 inch) diameter are to be equipped with worm gear operators. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Apollo #LC149 Series.

.2 DeZurik #BOS-CL Series.

.3 Nibco Series LD-2000.

.4 MAS #LD4-A-E.

.3 Butterfly Valve – Grooved Joint Copper Piping: Victaulic Co. of Canada Series 608 “COPPER CONNECTION”, Tyco Grinnell B680, or Shurjoint Model SJ-C300, 2065 kPa (300 psi) rated butterfly valves, each complete with a cast bronze body with grooved ends, resilient elastomeric coating bonded to a ductile iron disc suitable for potable water, bubble tight shut-off, and manual lever handle. Where piping is insulated provide stem extensions to clear insulation.

2.2 CHECK VALVES

.1 Horizontal: Lead Free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends. Acceptable products are:

.1 Kitz Corporation Code No. 823.

.2 Nibco #S-413-Y-LF.

.3 Toyo #237A-LF

.4 Watts Water Technologies (Canada), Inc. #LF600 up to 50 mm (2 inch)

.2 Vertical: Lead Free, Bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends. Acceptable products are:

.1 Kitz Corporation Code No. 826.

.2 Nibco #S-480-Y-LF.

2.3 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) water rated, 20 mm (3/4-inch) diameter straight pattern bronze or brass ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (3/4-inch) diameter garden hose, and a cap and chain. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Kitz Corporation Code 869 C/868 AC.

.2 Apollo #70-LF-100/200-HC.

.3 Nibco #S-585-80-LF.

.4 Toyo #5046-LF.

2.4 POTABLE HOT WATER AUTOMATIC FLOW LIMITING & BALANCING VALVES

.1 Brass, Solder end type, lead free, automatic flow limiting valve, valves designed to facilitate precise flow balancing of potable hot water. Operating pressure between 2 to 80 psi. Operating temperature range between 32F to 212F. Complete with changeable GPM flow cartridges, EPDM O-Ring and diaphragm, Polyphyenylsulfone orifice and certified to NSF/ANSI 61 & 372. Acceptable products are:

.1 Caleffi AutoFlow 127 Series.

.2 Hays Fluid Controls Model 2517LF.

.2 Solder end type, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with valved ports for connection to a differential pressure meter. Certified to NSF/ANSI 61 & 372. Acceptable products are:

.1 Armstrong Fluid Technology Model CBV-S.

.2 Tour and Anderson Model TBV-S or STAD/STAS.

.3 RWV #9519AB.

2.5 PARTITION STOPS

.1 Dahl Brothers Canada Ltd., Fig. 2300 Series or approved equivalent bronze key operated partition stops with Teflon impregnated lifetime packing, slotted spindles, extension tubes, stainless steel access plates, and three identified keys.

2.6 INTERIOR HOSE BIBBS

.1 'HB-1' Exposed – Cold Water: Cast bronze hose bibb with hose end vacuum breaker. Acceptable products are:

.1 Zurn #Z1341.

.2 Watts Water Technologies (Canada), Inc. #SC8-1.

.3 Jay R. Smith #5673

.4 Mifab #MHY-90.

.2 'HB-2' Exposed – Hot & Cold Water: Rough Brass hose bibb with 19mm hose end complete with built-in vacuum breaker with aluminum handles. Wall thickness to suit application. Acceptable products are:

.1 Woodford Model 22

2.7 VACUUM BREAKERS

.1 Threaded brass or bronze lead free 20 mm (3/4-inch) diameter hose connection vacuum breakers to CSA B64, each designed to connect to the hose bibb inlet and to be non-

removable when in place. Watts Water Technologies (Canada), Inc. LF8 or acceptable equivalent.

2.8 FLOOR DRAIN TRAP SEAL PRIMERS

.1 Electronic Primer:

.1 Precision Plumbing Products “PT Prime Time” Series, surface mount, CSA certified, 115 volt, 1 phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:

.1 A galvanized steel NEMA-1 cabinet complete with hinged door or cover plate.

.2 20 mm (3/4-inch) diameter NPT copper pipe inlet with shut-off valve and water hammer arrestor.

.3 A solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (1/2-inch) diameter compression type copper tube connections on 40 mm (1-1/2 inch) centres with quantity to suit the number of items to be primed.

.4 A control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.9 SHOCK ABSORBERS

.1 Type 304 stainless steel piping shock absorbers, each complete with a nesting type bellows and a casing of sufficient displacement volume to dissipate the kinetic energy generated in the piping system, and each sized to suit the connecting potable water pipe and equipment it is provided for. Acceptable products are:

.1 Zurn #Z1700 “SHOKTROL”.

.2 Precision Plumbing Products (PPP) “SS” Series.

.3 Jay R. Smith 5000 Series “HYDROTROL”.

.4 Mifab “HAMMERGUARD” WHB Series.

.5 Watts Water Technologies (Canada), Inc. SS Series.

2.10 POTABLE THERMOSTATIC MIXING VALVES

.1 Rough bronze lead free thermostatic mixing valve assemblies, each complete with ball type shut-off valves, pressure regulating valve, angle check stops, and dial type thermometer all mounted in a recessed or a surface wall mounted stainless steel cabinet, as shown on Drawings, with a plexi-glass window in door. Expand to pipe size show on Drawings before and after exiting the mixing valve:

.1 TMV-C1 (Building C): Provide Leonard TM-520B-LF-DT; 20 mm (3/4 in.) diameter inlets and 25 mm (1 in.) outlet. Maximum 35 kPa (5 psi) pressure drop @ 1.45 L/s (15 gpm).

.2 Individual fixture thermostatic valves to be sized by fixture manufacturer.

.2 Acceptable manufacturers are:

.1 Leonard Valve Company.

.2 Lawler Manufacturing Co, Inc.

.3 Powers (Watts Water Technologies Company).

.4 Symmons Industries, Inc.

.5 Acorn Engineering Company.

.3 .

3 Execution

3.1 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Provide shut-off valves on each branch to each piece of equipment, fixtures and wherever else indicated on Drawings.

.2 Provide check valves on pump discharge and wherever else indicated on Drawings.

3.2 INSTALLATION OF DRAIN VALVES

.1 Provide a drain valve at the bottom of potable water piping risers and at all other piping low points.

.2 Locate drain valves so that they are easily accessible.

3.3 INSTALLATION OF AUTOMATIC FLOW LIMITING & BALANCING VALVES

.1 Provide balancing valve(s) in potable hot water recirculation piping where shown.

.2 Locate each valve such that it is easily accessible.

3.4 INSTALLATION OF PARTITION STOPS

.1 Provide partition stops in potable water piping to each washroom plumbing fixture. Locate partition stops in piping near the floor level in inconspicuous locations. Confirm locations prior to roughing-in.

3.5 INSTALLATION OF HOSE BIBBS

.1 Provide hose bibs where shown and/or specified on the Drawings.

.2 Unless otherwise shown, specified or required, mount hose bibs approximately 915 mm (3 feet) above the floor. Confirm exact locations prior to roughing-in.

3.6 INSTALLATION OF VACUUM BREAKERS

.1 Provide a vacuum breaker for each potable water hose bibb that is not factory equipped with an integral vacuum breaker.

3.7 INSTALLATION OF TRAP SEAL PRIMERS

.1 Provide accessible trap seal primers to automatically maintain a water seal in floor drain traps. Install in accordance with the manufacturer's instructions and details.

.2 Connect each trap seal primer inlet with Type "L" hard copper tubing off the top of the nearest available potable water piping to plumbing fixtures or equipment.

.3 Where multiple traps (3 to 8) are to be primed by a single primer valve, provide distribution unit(s) and, where required, a supply tube. Wall mount level and plumb, and provide a clear plastic cover.

.4 In mechanical rooms, garage areas, and vestibules (remote locations) provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple traps (1 to 30) and wherever else indicated. Include for a 115 volt, 15 ampere circuit to each assembly extended from the nearest suitable panelboard and with wiring in conduit to the standards of Division 26.

.5 Above grade provide 12 mm (1/2-inch) Type "L" copper piping to each trap. Exposed piping is to be hard drawn. Concealed piping is to be soft.

.6 Below grade and concrete embedded provide 12 mm (1/2-inch) high density polyethylene tubing to each trap.

3.8 INSTALLATION OF SHOCK ABSORBERS

.1 Provide accessible shock absorbers in potable water piping at groups of plumbing fixtures, at the top of risers as required to prevent piping water hammer.

.2 Ensure that the size of each shock absorber is properly selected to suit the size of the potable water pipe and the equipment of the pipe is connected to.

.3 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with the manufacturer's published instructions and details.

3.9 INSTALLATION OF THERMOSTATIC MIXING VALVES

.1 Provide a potable hot water thermostatic mixing valve assembly where shown on Drawings and wall mount.

.2 Adjust each valve to design requirements and check and test operation. Set maximum temperature limit stops.

.3 Identify each valve and its water temperature delivery setting with an engraved plate.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 13 29 – Sump Pumps and Pits

.3 Section 22 42 00 – Plumbing Fixtures and Fittings.

.4 Section 33 31 13 – Sewerage Piping.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA B70, Cast iron soil pipe, fittings, and means of joining.

.2 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.

.3 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

.2 **Test Data:** Submit the following test data prior to application for Substantial Performance of the Work.

.1 Pipe leakage test sheets in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 A copy of the plumbing inspection certificate.

.3 Any other start-up or test data specified in this Section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 PIPE, FITTINGS AND JOINTS

.1 Adhesives and Sealants: Use sealants as recommended by the Manufacturer and in accordance with Section 01 35 22 – VOC requirements, and Section 01 60 00 – LEED product requirements as well as relevant ASTM standards.

2.2 PIPING AND FITTINGS

.1 **Solvent Weld PVC Sewer Pipe:** SDR 35, 150 mm (6") and below, rigid PVC hub and spigot pattern sewer pipe and fittings in accordance with CAN/CSA B182.2. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. Provide green coloured pipe for sanitary lines and white coloured pipe for storm lines.

.1 Acceptable Manufacturers

.1 Ipex Solvent Weld Sewer Pipe

.2 Royal Building Products Solvent Weld Sewer Pipe

.2 **Gasketed PVC Sewer Pipe:** SDR 35, 200 mm (8") and above, rigid PVC hub and spigot pattern sewer pipe and fittings in accordance with CAN/CSA B182.2, with gasket joints assembled with pipe lubricant from same manufacture as pipe. Provide green coloured pipe for sanitary lines and white coloured pipe for storm lines.

.1 Acceptable Manufacturers

.1 Ipex “Ring-Tite” Sewer Pipe

.2 Royal Building Products “DSLI” Sewer Pipe

.3 Next Polymers “Duraloc” Sewer Pipe

.3 **PVC DWV Pipe:** Ipex Inc. System 15 rigid PVC drain, waste, and vent pipe and fittings manufactured to CAN/CSA B181.2, complete with solvent weld joints. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. When used in buildings of non-combustible construction all PVC pipes shall be certified to CAN/ULC S102.2 and achieve a Flame Spread Rating not exceeding 25. System 15 shall not be used in high buildings or air plenums. For dry fire barrier penetration, an approved donut type firestop conforming to the requirements of ULC/CAN4-S115 M95 shall be installed at all fire rated walls.

.1 Acceptable Manufacturers

.1 Ipex “System 15” DWV Pipe

.2 Royal Building Products “LRS-25” DWV Pipe

.4 **Plenum Rated PVC DWV Pipe:** Ipex Inc. System XFR rigid PVC drain, waste, and vent pipe and fittings to CAN/CSA B181.2, complete with solvent weld joints. Solvent weld cement and primer (when required by manufacture) shall be same manufacturer as pipe. When used in buildings of non-combustible construction, high buildings, and air plenums all PVC pipes shall be certified to CAN/ULC S102.2, achieve a Flame Spread Rating not exceeding 25 and achieve Smoke Developed Classification not exceeding 50. For dry fire barrier penetration, an approved donut type firestop conforming to the requirements of ULC/CAN4-S115 M95 shall be installed at all fire rated walls.

.1 Acceptable Manufacturers

.1 Ipex “XFR” DWV Pipe

.2 Royal Building Products “HRS-2550” DWV Pipe

.5 **DWV Copper- Solder Joint:** Type DWV hard temper in accordance with ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.6 **Cast Iron:** Cast iron pipe, fittings and joints in accordance with CAN/CSA B70, couplings to CAN/CSA B602 (Class 4000).

.7 **DWV Copper-Grooved Coupling Joint:** Type DWV hard temper in accordance with ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic Co. "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings or Grinnell (Tyco Mechanical Products) Style 672.

3 Execution

3.1 UNDERGROUND MUNICIPAL SERVICE CONNECTION

.1 All underground sanitary and storm sewers outside the building footprint (from the outside of the foundation wall to the property line) shall be covered by the civil discipline under Section 33 31 13.

3.2 PIPING INSTALLATION REQUIREMENTS

.1 Provide all required drainage, waste, and vent piping. Pipe, unless otherwise specified in the Contract Documents, shall be as follows:

.1 For underground sanitary and storm pipe inside the building footprint use rigid **PVC Sewer Pipe**, minimum 100 mm (4") diameter. For pipe sizes 150 mm (6") diameter and smaller use **Solvent Weld PVC Sewer Pipe**, for all larger pipe diameters use **Gasketed PVC Sewer Pipe.**

.2 For sanitary and storm pipe inside the building and above ground in sizes up to and including 65 mm (2½") diameter type **DWV Copper** shall be used. Where permitted by the OBC, **PVC DWV Pipe** may be used in lieu of **DWV Copper**.

.3 For sanitary and storm pipe inside the building and above ground in sizes 75 mm (3") diameter and larger - **Cast Iron** shall be used except for drainage pump discharge pipe. Where permitted by the OBC, **PVC DWV Pipe** may be used in lieu of **Cast Iron**.

.4 In air plenums **Plenum Rated PVC DWV Pipe** shall be used in lieu of **PVC DWV Pipe**.

.2 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, the pipe has a smooth and uniform invert. Keep pipe thoroughly clean so that jointed compound will adhere. Inspect the pipe for defects before lowering the pipe into the trench. Do not use defective pipe.

.3 Unless otherwise specified in the Contract Documents, slope horizontal drainage piping above ground in sizes to and including 75 mm (3") diameter 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") diameter and larger 25 mm (1") in 2.4 m (8').

.4 Install and slope underground drainage piping to inverts or slopes indicated on the Drawings to facilitate straight and true gradients between the points shown. Verify available slopes before installing the pipes.

.5 Unless otherwise specified in the Contract Documents, slope horizontal branches of vent piping down to the fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 (4').

.6 Extend vent stacks up through the roof generally where shown but with exact locations to suit site conditions. Terminate vent stacks 457 mm (18") above the roof in vent stack covers.

.7 Provide proper dielectric unions at connections between copper pipe and ferrous pipe or equipment.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 13 16 – Drainage, Waste, and Vent Piping.

.3 Section 22 13 20 – Floor Drains.

.4 Section 22 13 23 – Oil and Sediment Waste Interceptors.

.5 Section 22 13 23 – Sump Pumps and Pits

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.2 ASTM A48, Standard Specification for Gray Iron Castings.

.3 ASTM A563, Standard Specification for Ductile Iron Castings.

.4 ASTM B584, ASTM Specification for Copper Alloy Sand Castings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1, Pipe Threads, General Purpose, Inch

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.

.2 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

.3 CSA B272-93, Prefabricated Self-Sealing Roof Vent Flashings.

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 CLEANOUTS

.1 Horizontal Piping: TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping:

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, epoxy coated cast iron cleanout tees, each gas and

water-tight, complete with an ABS tapered thread plug. Acceptable cast iron cleanout tees are:

.1 Zurn #Z-1445

.2 Jay R. Smith #4510

.3 Mifab #C1460

.4 Watts Water Technologies (Canada) Inc. #CO-460

.3 Urinal(s): Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandalproof stainless steel securing screw. Acceptable products are:

.1 Zurn #Z-1666-1-VP

.2 Jay R. Smith #SQ4-1819

.3 Mifab #C1440-RD-6

.4 Watts Water Technologies (Canada) Inc. #CO-440-RD-6

2.2 FLOOR CLEANOUT TERMINATIONS

.1 Baked epoxy coated cast iron terminations, each complete with a solid stainless steel gasketed access cover to suit the floor finish, a cleanout plug, and captive stainless steel securing hardware. Acceptable products are:

.1 Zurn #ZS-1602-SP Series

.2 Jay R. Smith #4020-SS-F-C Series

.3 Mifab #C1000-R-3-34

.4 Watts Water Technologies (Canada) Inc. #CO-1200-R-3-34

.2 All cleanout terminations in areas with a tile or sheet vinyl finish are to be as above but with a square top in lieu of a round top. Refer to the Room Finish Schedule.

3 Execution

3.1 INSTALLATION OF CLEANOUTS:

.1 Provide cleanouts in drainage piping in locations as follows:

.1 In the building drain or drains as close as possible to the inner face of the outside wall, and, if a building trap is installed, locate the cleanout on the downstream side of the building trap.

.2 At or as close as practicable to the foot of each drainage stack.

.3 At maximum 15 m (50 foot) intervals in horizontal pipe 100 mm (4 inch) diameter and smaller.

.4 At maximum 30 m (100 foot) intervals in horizontal pipe larger than 100 mm (4 inch) diameter.

.5 In the wall at each new urinal or bank of urinals in a washroom.

.6 Wherever else shown on the Drawings.

.2 Cleanouts are to be the same diameter as the pipe in piping to 100 mm (4 inch) diameter, and not less than 100 mm (4 inch) diameter in piping larger than 100 mm (4 inch) diameter.

.3 Cleanouts in vertical piping are to be cleanout tees, cast iron in piping 75 mm (3 inch) diameter and larger, copper or bronze in piping smaller than 75 mm (3 inch) dia.

.4 Cleanouts in horizontal piping are to be TY fittings with removable plugs.

.5 Where cleanouts are concealed behind walls or partitions, install the cleanouts near the floor and so that the cover is within 25 mm (1 inch) of the finished face of the wall or partition.

3.2 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS:

.1 Where cleanouts occur in horizontal inaccessible underground piping, extend the cleanout TY fitting up to the floor and provide a cleanout termination set flush with the finished floor.

.2 In waterproof floors, ensure that each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit the floor finish. Refer to Room Finish Schedules.

.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 13 16 – Drainage, Waste, and Vent Piping.

.3 Section 22 13 19 – Drainage, Waste, and Vent Piping Specialties.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.2 ASTM A48, Standard Specification for Gray Iron Castings.

.3 ASTM A563, Standard Specification for Ductile Iron Castings.

.4 ASTM B584, ASTM Specification for Copper Alloy Sand Castings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1, Pipe Threads, General Purpose, Inch

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B70, Cast iron soil pipe, fittings, and means of joining.

.2 CAN/CSA B602, Mechanical couplings for drain, waste, and vent and sewer pipe.

.3 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 FLOOR DRAINS

.1 Coated cast iron body vandalproof screws, each complete with a 12 mm (1/2-inch) diameter trap primer connection, and each in accordance with the Floor Drain Schedule below.

.2 All floor drains in areas with a tile or sheet vinyl finish are to be as above but with a square grate in lieu of a round grate. Refer to the Room Finish Schedule.

3 Execution

3.1 INSTALLATION OF FLOOR DRAINS

.1 Provide floor drains where shown on the Drawings.

.2 Equip each drain with a trap and trap primer line.

.3 In equipment rooms and similar areas, exactly locate floor drains to suit the location of mechanical equipment and equipment indirect drainage piping.

.4 Confirm the exact location of drains prior to roughing in.

.5 Temporarily plug floor drains during construction procedures. Remove plugs during final cleanup work and demonstrate free and clear operation of each drain. Replace any damaged grates.

FLOOR DRAIN SCHEDULE

Type and Description	Zurn Model No.	Jay R. Smith Model No.	Mifab Model No.	Watts Water Technologies (Canada) Inc. Model No.
FD-1, floor drain, finished areas, coated cast iron body, flashing clamp with seepage openings and adjustable 127 mm (5") dia. nickel bronze 6.35 mm (1/4") thick strainer, secured with S.S. screws, 100 mm (4") throat on strainer. Drain shall be complete with trap primer connection. In locations with Heavy Duty vertical loads (>2500 lbs) a stainless steel strainer shall be used instead of nickel bronze.	ZN-415-B5-P-VP	2005-A05-NB-U-P050	F1100-C5-1-7-6	FD-100-C-A5-1-6
FD-2, shower drain, floor drains in quarry or mosaic tiled areas shall be similar to floor drains in finished areas but with 127 mm x 127 mm (5" x 5") square nickel bronze strainer	ZN-415-S5	2005B	F1100-C-S5-1	FD-100- C-L5-1

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 22 13 16 – Drainage, Waste, and Vent Piping.

.3 Section 22 13 19 – Drainage, Waste, and Vent Piping Specialties.

.4 Section 22 13 20 – Floor Drains.

.5 Section 22 13 23 – Oil and Sediment Waste Interceptors.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)

.1 ASTM A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.2 ASTM A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.3 ASTM D3753, Standard Specification for Glass-Fiber Reinforced Polyester Manholes and Wetwells.

.4 ASTM A48, Standard Specification for Gray Iron Castings.

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B1.20.1, Pipe Threads, General Purpose

.3 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 **Shop Drawings**: Submit shop drawings for all products specified in this Section except pipe and fittings. Shop drawings are to include all components including but not limited to basin, lift out rail system, valves, pump, control panel layout drawings, wiring diagrams with wire numbers, individual components within panel, motor shop drawing, etc.

.2 **Test Data:** Submit the following test data prior to application for Substantial Performance of the Work.

.1 Pipe leakage test sheets in accordance with Section 23 05 00 – Common Work Results for HVAC.

.2 A copy of the plumbing inspection certificate.

.3 Any other start-up or test data from equipment specified in this Section.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 SUMP BASIN

.1 The basin package shall include the following: fiberglass basin with anti-flotation collar, break away fitting lift out system with guide rails, isolation valve, mechanical floats, basin cover, check valve, lifting chain, field locatable conduit fitting, and vent. All equipment in the wet well shall be capable of constant submerge in sewage to a minimum depth of 30 feet without electrical power being energized.

.2 Fiberglass Sump Basin:

.1 Provide sump basin capacities and dimensions in accordance with the Sump Pumps Schedule at the end of this document.

.2 The basin shall be fiberglass reinforced polyester resin with a 76.2 mm (3") ballast support flange.

.3 The basin shall be furnished with a flexible inlet flange to accept a 114 mm (4.50") OD DWV pipe. Final inlet location to be determined by contractor.

.4 Outlet shall terminate outside the basin with a bulkhead female NPT fitting of the same material specified in section 2.2. The manufacturer shall guarantee all bulkhead penetrations are watertight. Final outlet location to be determined by contractor.

.5 Basin shall have provisions for 2” NPT vent.

.6 The basin FRP wall laminate thickness shall vary with the wet well depth to provide the aggregate strength to meet the tensile and flexural physical property requirements.

.7 The basin FRP wall laminate must be designed to withstand wall collapse or buckling based on a hydrostatic pressure of 305 kg/sq. m (62.4 lb/sq. ft.), a saturated soil weight of 1922 kg/cu. m (120 lbs/cu. ft.), and a soil modulus of 3418 kg/sq. m (700 lb/sq. ft.).

.8 Basin must comply with the pipe stiffness values as specified in ASTM D 3753. The basin laminate must be constructed to withstand or exceed 150% of the assumed loading on any depth.

.9 The finished FRP laminate will have a Barcol hardness of at least 90% of the resin manufactures specified hardness for the fully cured resin. The Barcol Hardness shall be the same for both interior and exterior surfaces.

.10 The center deflection of any empty tank bottom must be less than 3/8 inch as not to interfere with bottom pump mounting requirements and rail systems.

.11 The wet well top flange shall have an outside diameter greater than the inside diameter of the wet well. The top flange shall be designed to accommodate the mounting of a cover, using 304 stainless steel fasteners. Non corroding stainless steel threaded inserts shall be fully encapsulated with non-continuous mat or chopped-strand glass fiber reinforcement.

.12 Sump basin shall be Barnes or approved equivalent.

.3 Pump Removal and Rail System:

.1 Each basin shall be equipped with a 304 stainless steel pipe guide rail assembly to facilitate removal of the pump(s) from ground level.

.2 A stainless steel lifting chain with harness shall be supplied for pump removal.

.3 Pump removal system shall include the use of a break away fitting that must not require the loosening of fasteners to facilitate pump removal, and shall provide for

automatic alignment and re-connection of discharge piping for the replacement pump.

.4 Pump replacement shall be capable of being accomplished while the basin is full of sewage without the need to dewater the basin

.4 Basin Cover:

.1 Provide a steel cover for all basins.

.2 Basin covers shall be flush with finished floor and provided with all necessary mounting hardware.

.3 Covers shall have a minimum load rating of 732 kg/sq. m (150lb/sq. ft.).

2.2 DISCHARGE PIPING, & FITTINGS

.1 **Stainless Steel – Threaded Joint:** Type 304 Schedule 40, ASTM A312, seamless stainless steel piping complete with Class 150, ASME B1.20.1 NPT threaded fittings (ASTM A743) and screwed joints.

2.3 SIMPLEX SUMP PUMP AND CONTROLS

.1 Provide submersible sump pump and control box in accordance with the schedule at the end of this document, complete with:

.1 A cast iron (ASTM A-48, Class 30) pump casing, motor cover and pressure switch housing, complete with stainless steel fasteners.

.2 An oil filled, 115 volt, 1 phase, overload protected submersible motor with a minimum of 3 m (10 feet) of PVC jacketed power cord prewired to the motor.

.3 An open, two-vane type, non-clog cast iron impeller secured to a 416 stainless steel pump and motor shaft.

.2 **Three Control Switches**: Snap Action, each sealed in a polypropylene float and complete with a minimum of 3 m (10 feet) of power cord, two float switches for pump "ON-OFF" control, the other float switch for high water level alarm. Provide external float weights for an accurate pivot point.

.3 **Wall Mounted Control Panel**:

.1 NEMA 1 enclosure (Indoor),

.2 Fused disconnect switch,

.3 Magnetic Motor Starter/Contactor,

.4 Float Switch Terminal Block

.5 HOA switch

.6 Pump “ON” green LED,

.7 Alarm with red flashing LED which remains illuminated until the alarm is cleared,

.8 Audible bell with alarm silencing switch,

.4 Three auxiliary contacts for remote annunciation to BAS

.1 “ON” status

.2 “OFF” status

.3 “HIGH LEVEL ALARM” status

.5 A stainless steel bracket to support float switch cables in the sump pit.

.6 Acceptable manufacturers:

.1 Barnes Pumps

.2 Hydromatic Pumps

.3 Flygt

.4 F.E. Myers (Canada) Ltd.

.5 Zoeller

3 Execution

3.1 INSTALLATION OF SUMP BASIN

.1 Coordinate pit/basin location and installation with Section 03 00 00 (Concrete) for sleeving through concrete slab, bedding, and ballast.

.2 Provide bedding, ballast and backfill material as required by manufactures recommendations. In absence of a manufacture recommendation consult specifying engineer before installation.

.3 Ensure pits have all required inlet and outlet connections for piping and wiring; locate all connections at the correct elevations.

3.2 PIPING INSTALLATION REQUIREMENTS

.1 Provide all required drainage, waste, and vent piping. Pipe, unless otherwise specified in the Contract Documents, shall be as follows:

.1 For sanitary and storm pump discharge piping connected within the sump basin provide 304 **Stainless Steel** piping.

.2 After the discharge piping has been connected to the gravity sanitary or storm system; the piping material type shall transition to the material specified in Section 22 13 19**.**

.2 Provide venting pipe for sump basin as required by OBC and manufacturer. Venting pipe material and installation requirements shall follow specification section 22 13 19.

3.3 INSTALLATION OF SUMP PUMP AND CONTROLS

.1 Provide submersible drainage pump(s) on a mounting base in the sump.

.2 Provide all required sump piping, including a shut-off valve and a check valve for each pump. Ensure that piping is easily removable for removal of pump(s) from the sump.

.3 Install float switch(es) at the proper height in the sump and secure cable to a sump wall mounted bracket such that cables cannot twist around each other.

.4 Electrical trade (Division 26) to provide connection location for the Control Panel, installation of all power and control cables downstream of the panel, including extension and connection to starting and control equipment shall be part of the mechanical work of Division 22.

.5 Hand the pump starter and control panel(s) and high water level alarm panel(s) to the electrical trade (Division 26) at the site for installation.

.6 Provide sump and pump accessories.

.7 Clean sump(s) prior to application for Substantial Performance.

.8 Arrange for the pump supplier to visit the site to examine the installation and certify it correct in writing, to supervise start-up and test operation, and to demonstrate proper operation and maintenance procedures. Submit a copy of the certification letter.

SUMP PUMP SCHEDULE

Unit Tag	**SP-1**	**SP-2**
Manufacturer	Barnes	Barnes
Model No.	SE-L	SE-L
Service	Southern Elevator (EL-1)	Central Elevators (EL-2 & EL-3)
Location	A1032 – CSPS Janitor	A1097 – Corridor
Type	Submersible Non-Clog Sewage Pump	Submersible Non-Clog Sewage Pump
Capacity, L/s (USgpm)	3.15 (50)	6.30 (100)
Head, m (f)	3.66 (12)	3.66 (12)
Fluid	Water	Water
Discharge outlet, mm (in)	50 (2)	50 (2)
Impeller Diameter, mm (in)	108 (4.25)	124 (4.875)
Electrical		
Motor Power, kW (HP)	0.37 (0.5)	0.37 (0.5)
RPM	1750	1750
Volts/Phase/Hz	120/1/60	120/1/60
Sump Dimensions		
Diameter, mm (in)	1,220 (48)	1,220 (48)
Height, mm (in)	2,438 (96)	3,048 (120)

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General requirements.

.2 Section 22 11 16 – Domestic water piping.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-B45 Series, Plumbing Fixtures.

.2 CAN/CSA-B125.3, Plumbing Fittings.

.3 CAN/CSA-B651, Accessible Design for the Built Environment.

1.3 ACTIONS AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.3 Provide manufacturer's printed product literature and datasheets for fixtures and include product characteristics, performance criteria, physical size, finish and limitations.

.4 Closeout Submittals:

.5 Provide maintenance data in accordance with Section 01 78 00.

.6 Include:

.1 Description of fixture and trim, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

.7 Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.2 Separate waste materials for reuse and recycling.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material, in appropriate on-site bins.

.4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

2 Products

2.1 PLUMBING FIXTURE AND FITTING SCHEDULE

.1 For plumbing fixture and fitting manufacturers, catalogue numbers, and specific requirements, refer to the Drawing schedule of plumbing fixtures and fittings.

.2 Unless otherwise specified in the Contract Documents, requirements specified below apply to the plumbing fixtures and fittings scheduled on the Drawings.

2.2 GENERAL: PLUMBING FIXTURES AND FITTINGS

.1 Fixtures and fittings, where applicable, shall be in accordance with the requirements of CSA B45 Series, Plumbing Fixtures.

.2 All fixtures and fittings for use by the handicapped are to be in accordance with Ontario Building Code requirements.

.3 Unless otherwise specified in the Contract Documents, all vitreous china and porcelain enamelled fixtures shall be white.

.4 Unless otherwise specified in the Contract Documents, all fittings exposed to view shall be chrome plated and polished.

.5 All fittings located in areas other than private washrooms shall be vandal-proof.

.6 All fixtures carriers shall be suitable in all respects for the fixture they support and the construction in which they are located.

2.3 WC-1: WALL MOUNTED TOILET - FLUSH VALVE - NO TOUCH

.1 **American Standard Afwall Millennium FloWise Elongated #3351.101.020 HET Toilet,** Vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, elongated bowl, White Finish, Wall hung, Siphon jet flush action, Operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, Condensate channel, 305 mm x 254 mm (12" x 10") water surface, Siphon jet flush action, Condensate channel, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, Toilet seat not included, 38 mm (1-1/2") dia. Top spud.

.2 **American Standard Commercial #5901.100.020 Toilet Seat,** Heavy Duty, For elongated bowl, open front, White Finish Solid polypropylene plastic, Less cover, Reinforced stainless steel check hinges, Post nuts and washers.

.3 **American Standard Selectronic #606B.121, Exposed Flush Valve** For Top Spud Toilet, Polished Chrome finish, 4.8 L (1.28 US Gal) per flush, self-cleaning brass piston with integral wiper spring prevents clogging, Proximity flush valve with programmable, multi-function infrared sensor, True mechanical over-ride button, 1" IPS bak-chek angle stop, Flush tube for 292 mm (11-1/2") rough-in, outlet includes 38 mm (1-1/2") vacuum breaker for back-flow prevention, Chrome plate only required when power supply must be installed from the front, AC Powered (Hard Wired).

.4 **American Standard #PK00.HAC, Hardwired Hardwired Ac - Power Kit,** Includes 10' long extension cable.

.5 **Watts #ISCA-101-M11 single horizontal Adjustable Toilet Carrier,** mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent, 158.8 kg (350 lbs) static load. 305 mm (12") finished metal stud wall to back of pipe space.

.6 **Champion MI-TR Series #MI-HUB TR-440 Drain Coupling,** Coupling, no-hub, type 300 AISI stainless steel band, type 300 AISI stainless steel eyelets, elastomeric compound gasket meeting the requirements of ASTM C-564, type 300 AISI stainless steel shield, Tested to maintain 4.3 psi of water pressure at 60 inch lb min/max torque bolt tightness, Tested and certified to ASTM Standard 1460-2012 and CSA Standad B602-2010 and listed with IAPMO. All models are listed to the National Plumbing Code of Canada and relevant Canadian Standard (s) and bear the cUPC mark of conformity. Non constant temperature rating is 140ºF.

2.4 WC-2: WALL MOUNTED TOILET – BARRIER FREE - FLUSH VALVE - NO TOUCH

.1 **American Standard Afwall Millennium FloWise Elongated #3351.101.020 HET Toilet,** Vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, elongated bowl, White Finish, Wall hung, Siphon jet flush action, Operates in the range of 4.2 L to 6 L (1.1 US Gal to 1.6 US Gal) per flush, Condensate channel, 305 mm x 254 mm (12" x 10") water surface, Siphon jet flush action, Condensate channel, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, Toilet

seat not included, 38 mm (1-1/2") dia. Top spud.
Mount fixture 16"(406mm) above finished floor to rim of toilet (or as required to meet local codes).

.2 **American Standard Commercial #5901.100.020 Toilet Seat,** Heavy Duty, For elongated bowl, open front, White Finish Solid polypropylene plastic, Less cover, Reinforced stainless steel check hinges, Post nuts and washers.

.3 **American Standard Selectronic #606B.121, Exposed Flush Valve** For Top Spud Toilet, Polished Chrome finish, 4.8 L (1.28 US Gal) per flush, self-cleaning brass piston with integral wiper spring prevents clogging, Proximity flush valve with programmable, multi-function infrared sensor, True mechanical over-ride button, 1" IPS bak-chek angle stop, Flush tube for 292 mm (11-1/2") rough-in, outlet includes 38 mm (1-1/2") vacuum breaker for back-flow prevention, Chrome plate only required when power supply must be installed from the front, AC Powered (Hard Wired)..

.4 **American Standard #PK00.HAC, Hardwired Hardwired Ac - Power Kit,** Includes 10' long extension cable.

.5 **Franke Midland #CM-16104-WM,** Toilet Back Rest, Satin finish type 304 18 GA. (1.2 mm) stainless steel bar, 152 mm (6") back to front, 32 mm (1-1/4") tubing diameter, antique white solid core plastic laminate panel.

.6 **Watts #ISCA-101-M11 single horizontal Adjustable Toilet Carrier,** mounted on concrete floor, all epoxy coated cast iron fitting, adjustable ABS slide nipple with integral test cap and neoprene bowl gasket, wasted plated hardware, chrome cap nuts, tiling frame, 102 mm (4") no hub waste, 51 mm (2") no hub vent, 158.8 kg (350 lbs) static load. 305 mm (12") finished metal stud wall to back of pipe space.

.7 **Champion MI-TR Series #MI-HUB TR-440 Drain Coupling,** Coupling, no-hub, type 300 AISI stainless steel band, type 300 AISI stainless steel eyelets, elastomeric compound gasket meeting the requirements of ASTM C-564, type 300 AISI stainless steel shield, Tested to maintain 4.3 psi of water pressure at 60 inch lb min/max torque bolt tightness, Tested and certified to ASTM Standard 1460-2012 and CSA Standad B602-2010 and listed with IAPMO. All models are listed to the National Plumbing Code of Canada and relevant Canadian Standard (s) and bear the cUPC mark of conformity. Non constant temperature rating is 140ºF.

2.5 UR-1: WALL HUNG URINAL – EXPOSED FLUSH VALVE - NO TOUCH - HARDWIRED

.1 **American Standard Pintbrook #6002.001.020 Urinal**, operates in the range of 0.5 L to 1.9 L (0.125 US Gal to 0.5 US Gal) per flush, wall hung, washdown action, Pintbrook, flushing rim, 19 mm (3/4") dia. Top spud, elongated rim, integral P-trap, outlet connection 51 mm (2"), wall hanger, white finish.

.2 **Exposed Flushometer: Sloan ECOS #ECOS 186-0.125**, for Top Spud urinal, 0.5 L (0.125 US Gal) factory set flow, quiet action 'PERMEX' diaphragm type with linear filtered by-pass and Vortex Cleansing Action, infrared sensor with multiple-focused lobular sensing fields for high and low target sensing, circuitry automatic stadium function, V.P. Smooth design stop cap on bak-chek angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, high pressure vacuum breaker, patented 'Isolated Operator' for superior performance under a heavy duty metal stylish cover with plastic optical face, line powered with 6 VAC step down transformer.

.3 **Box Mount Hard-Wired Transformer: Sloan #EL-451**, 120 VAC input/ 6 VAC output, 50/60 Hz (25 VA).

.4 **Fixture Carrier: Watts #CA-321**, mounted on concrete floor, epoxy coated top and bottom universal steel hanger plates, heavy gauge epoxy coated steel offset uprights with welded feet supports. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

.5 **Urinal Wall Access Cleanout: Watts #WUCO**, two (2) piece expandable plug with 102 mm (4") diameter stainless steel access cover, secured with vandal proof stainless steel screw.

.6 **Drain Coupling: Champion MI-TR Series #MI-HUB TR** Coupling, no-hub, type 300 AISI stainless steel band, type 300 AISI stainless steel eyelets, elastomeric compound gasket meeting the requirements of ASTM C-564, type 300 AISI stainless steel shield, Tested to maintain 4.3 psi of water pressure at 60 inch lb min/max torque bolt tightness, Tested and certified to ASTM Standard 1460-2012 and CSA Standad B602-2010 and listed with IAPMO. All models are listed to the National Plumbing Code of Canada and relevant Canadian Standard (s) and bear the cUPC mark of conformity. Non constant temperature rating is 140ºF

2.6 LAV-2: WALL HUNG BASIN - BARRIER FREE - ELECTRONIC FAUCET - THERMOSTATIC MIXING VALVE

.1 **Sink:** American Standard Wheelchair #9141.011.020 basin, 3 holes, 4" (102 mm) center, 509 mm x 686 mm x 168 mm (20-1/16" x 27" x 6-5/8") high, vitreous china, white finish, for carrier with concealed arms, front overflow, faucet ledge.

.2 **Faucet:** Sloan Optima #ETF-80-4-LT Electronic Faucet, chrome plated with black throat finish, cast brass, 1.9 LPM (0.5 GPM) aerator spray outlet, 130 mm (5-1/8") projection reach, infrared sensor with screw adjustable range, under counter filtered solenoid valve with serviceable strainer filter, module control assembly housed in splash proof junction box, 24VAC 50/60Hz, vandal proof box.

.3 **Box Mount Hard-Wired Transformer:** Sloan #EL-154, 120 VAC/ 24 VAC, 50 VA.

.4 **Thermostatic Mixing Valve:** Sloan #BDT, solid bimetal (bronze, brass, stainless steel), Hot limit stop set to a maximum of 43 °C (109.4 °F). Screwdriver adjustment temperature dial with scale: COLD-HOT. Provide tee, adaptors and flex. copper tubing to suit installation.

.5 **Drain:** American Standard #2411.015.002 Open Grid Drain, Polished Chrome finish cast brass body, 32 mm (1-1/4") tailpiece. Insulate all plumbing hardware under sink.

.6 **Lavatory Stop:** McGuire #LFH170BV Faucet Supplies, chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, escutcheon and flexible copper risers. Insulate all plumbing hardware under sink.

.7 **Trap:** McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend. Insulate all plumbing hardware under sink.

.8 **Carrier:** Watts #WCA-411-WC Basin Carrier, concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

2.7 KS-1: STAINLESS STEEL – COUNTERTOP MOUNTSINK – SINGLE HANDLE FAUCET

.1 **American Standard #20DB.8312083S.075 Double Bowl Countertop Mount Sink,** 3 holes, 8" (203 mm) center, 797 mm (31-3/8") wide x 521 mm (20-1/2") long x 203 mm (8") high deep, Counter mounted, backledge, Grade 20 GA. (1.0 mm) type 304 stainless steel, Stainless steel finish, Mounting clips provided, Side and bottom sound deadening pads with undercoating, Waste fitting included.

.2 **American Standard Reliant+ #4205.000.002 Single handle Faucet,** Polished Chrome finish, Metal deck plate, Cast brass, Washerless ceramic disc cartridge, Aerator outlet, Cast brass swing spout, 235 mm (9-1/4") projection reach, Lever handle.

.3 **American Standard #605XTMV1070.007, Point Of Use Thermostatic Water Mixing Valve,** Bronze body, Temperature adjustment by using a hex wrench, 10 mm (3/8") inlets compression fittings with stainless steel 508 mm (20") flexible hoses and 13 mm (1/2") MNPT

outlet connection, Built-in checks, Housed in 127 mm x 86 mm x 81 mm (5" x 3-3/8" x 3-3/16") enclosure. Set valve temperature at 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation. Provide tempered water to hot side of faucet.

.4 **McGuire #LFBV170 Faucet Supplies,** Chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, Escutcheon and flexible copper risers.

.5 **McGuire #8912CB P-Trap,** heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, Box flange and Seamless tubular wall bend.

2.8 MS-1: TERRAZZO – FLOOR MOUNTED – DOUBLE HANDLE WALL MOUNT FAUCET

.1 **FIAT #TSB3000 Square Service / Mop Sink,** 610 mm (24") wide x 610 mm (24") long x 305 mm (12") high deep, Floor mounted, terrazzo composed of precast terrazzo, one piece stainless steel cast integral on all sides, 152 mm (6") drop front, integral stainless steel drain assembly and strainer plate, 3" (76 mm) outlet. Complete with drain gasket.

.2 **American Standard Yoke #8354.112.002 Wall Mounted Two handles Faucet,** Polished Chrome finish, Flexible installation within the range of 6" (152 mm) to 10" (254 mm), Cast brass body, Washerless ceramic disc valve cartridges, 22.7 LPM (6.0 GPM) unrestricted hose end outlet, Spout with atmospheric vacuum breaker and bucket hook, 237 mm (9-5/16") from wall to outlet reach, Lever handles, top brace.

.3 **Provide P-Trap,** Same material as the connecting pipe drain..

2.9 SH-1: SHOWER – BARRIER FREE - PRESSURE BALANCING SHOWER VALVE

.1 **Shower Valve:** American Standard Colony Pro #T075.500.002 Pressure Balancing Shower Valve Trim, Polished Chrome finish, 191 mm (7-1/2") round shaped trim face plate, on/off, volume and temperature control single lever handle. American Standard #R115 Pressure Balance in-wall Shower Rough Valve, cast brass body, 13 mm (1/2") Female Thread IPS inlet(s)/outlet(s), ceramic disc valve cartridges, integral hot water limit stop, less stops, back-to-back capability.

.2 **Handheld Showerhead:** American Standard #1660.500.002 3-Function Hand shower, 240 mm (9-7/16") long, 85 mm (3-3/8") face dia. 9.5 LPM (2.5 GPM) max flow rate, 240 mm (9-7/16") long, conventional spray/ aerated flow/ massage action spray pattern options, pressure compensating flow control device, Easy Clean spray nozzles, check valve included.

.3 **Showerhead Slide Bar:** American Standard #1660.225.002 hand shower slide bar, polished chrome finish, 610 mm (24") high cylindrical bar, adjustable bracket for personal shower, anchors/screws and mounting brackets included.

.4 **Shower Hose and Wall Supply:** American Standard #8888.035.002 Hand Shower Metal Hose 1524 mm (60") long. American Standard #1660.400.002 Hand Shower In-Line Vacuum Breaker, installed between supply outlet and shower hose. American Standard #8888.037.002 hand shower wall supply, polished chrome finish, brass construction, round shape, 13 mm (1/2") NPT female thread inlet, 13 mm (1/2") hose connection.

.5 **Drain:** Watts Drainage Products FD-100-C-L epoxy coated cast iron floor drain with anchor flange, reversible membrane clamp with primary and secondary weepholes, 1/2"(13 mm) thick, 5”x5” (127mm x 127 mm) adjustable square nickel bronze strainer with standard 3” (75 mm) outlet.

.6 **Trap: Provide P-Trap,** same material as the connecting pipe drain.

2.10 ACCEPTABLE MANUFACTURERS

.1 **Vitreous china and enameled cast iron or steel fixtures:** Zurn, Sloan, American Standard, Toto, and Kohler.

.2 **Stainless steel sinks:** Franke, AERO, Novanni Stainless Inc., Kindred Industries "Aristaline”.

.3 **Precast terrazzo fixtures:** Acorn, Fiat Products Ltd. and Stern-Williams.

.4 **Water closet seats:** Zurn, Bemis, Centoco, Olsonite and Beneke.

.5 **Flush valves:** Zurn, Sloan, American Standard, Toto, and Delta Commercial.

.6 **Fixture carriers:** Zurn, Mifab, Jay R. Smith and Watts Industries .

.7 **Faucets:** unless otherwise specified, Zurn, Delta Commercial, American Standard, Kohler and Chicago Faucet.

.8 **Fixture trim:** unless otherwise specified, McGuire, Zurn, American Standard , Kohler.

.9 **Water mixing valves and associated trim:** Powers, Zurn, Crane, Symmons, American Standard, Bradley and Kohler.

.10 **Shower valves:** American Standard, Moen, Kohler, Delta Commercial, Grohe.

.11 **Floor drains:** Watts Industries, Zurn, Mifab, Jay R. Smith.

3 Execution

3.1 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

.1 Provide all required plumbing fixtures and fittings.

.2 Provide isolation valves (ball valves) for all fixtures.

.3 Connect plumbing fixtures and fittings with piping sized in accordance with the Drawing schedule.

.4 Confirm the exact location of all plumbing fixtures and trim prior to roughing-in.

.5 When installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.

.6 **Counter Mounted Fixtures and Trim:** Supply templates for all counter mounted fixtures and trim and hand to the trade who will but the counter. Ensure openings in the counter are properly located.

.7 **Electronic Lavatory Faucets:** Locate control panels for electronic faucets under the lavatories and recessed into the wall. It is the intent to locate the transformer(s) (power converter(s)) in the wall cavity or concealed under counters. Provide access doors accordingly for servicing of transformer(s). Coordinate locations with the work of Division 26 that will provide 120 vac line supply to the transformers(s). Provide low voltage wiring from the transformer(s) to each terminal point in control panel(s) under lavatories. All water and electronic supply from control panel to faucet shall be through the flexible conduit supplied with the control panel. Connect hot and cold water piping to the mixing valve in each box, and tempered water piping from each mixing valve to the faucet. Set mixing valve maximum temperature limit stops to 43ºC. (109ºF) after potable water systems (hot and cold) are complete. Ensure that each programmable controller is properly programmed, and that water off after deactivation is set for three seconds. **Note:** All electrical line supply and low voltage wiring, including any wall receptacles as well as low voltage wiring to boxes shall be concealed.

.8 **Electronic Flush Valves:** Locate the transformer(s) (power converter(s)) in the wall cavity next to fixtures to be served. Provide access doors accordingly for servicing of transformer(s). Coordinate locations with Division 26 who will provide 120 vac line supply to the transformers(s). Provide low voltage wiring from the transformers(s) to each electronic flush valve terminal point. Note: All electrical line supply and low voltage wiring, including any wall receptacles as well as low voltage wiring to boxes shall be concealed.

.9 **Thermostatic Mixing Valves:** The device shall be designed to be installed at a single outlet. It may be used to supply individual outlets when there is sufficient supply pressure. Ball

valves shall be installed on the hot and cold inlet supplies. Temperature shall be field set. Maximum pressure differential shall be 103 kPa (15 psi) between hot and cold inlets. Integral check valves and strainer screen shall be installed on hot and cold supply.

.10 **Shower Fittings:** Confirm exact mixing valve and shower head locations with the Architect prior to roughing-in.

3.2 ADJUSTING

.1 Adjust the water flow rate to design flow rates.

.2 Adjust the pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators: Verify operation, cleanliness.

.2 Vacuum breakers, backflow preventers: Verify operation under all conditions.

.3 Thermostatic controls:

.4 Verify temperature settings, operation of control, limit and safety controls.

3.3 CLEANING AND PROTECTION

.1 After completing the installation of fixtures, inspect and repair damaged finishes.

.2 Clean fixtures, faucets, valves and other fittings with the manufacturers' recommended cleaning methods and materials.

.3 Provide protective covering for installed fixtures and fittings.

.4 Do not allow the use of fixtures for temporary facilities unless approved in writing by the Owner.

END OF SECTION

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 21 16 – Hydronic Piping Specialties.

.3 Section 23 21 23 – Hydronic Pumps.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ANSI/ASME B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.

.6 ANSI/ASNE B31.9, Building Services Piping.

.2 ASTM International Inc.

.1 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications.

.3 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.4 ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.5 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.6 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.7 ASTM B88, Standard Specification for Seamless Copper Water Tube.

.8 ASTM B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

.9 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.10 ASTM F876, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.11 ASTM F877, Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.

.12 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

.3 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems

.4 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Product Data:

.1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHIMS MSDS – Materials Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

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

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 HYDRONIC PIPING, FITTINGS AND JOINTS

.1 **Black Steel – Grooved Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with:

.1 Cast ductile iron grooved end fittings conforming to ASTM A536.

.2 Victaulic Style 07 "Zero-Flex", Victaulic Corporation Style 107 "QuickVic", Tyco Grinnell (Tyco Mechanical Products) Style 772, Anvil International, Gruvlok Fig. 7401 "Rigidlok" or Shurjoint Model Z07 rigid couplings for piping in the Mechanical Rooms and for piping risers, Victaulic Corporation Style 77, Tyco Grinnell (Tyco Mechanical Products) Style 707, Anvil International, Gruvlok Fig. 700 or Shurjoint (Tyco Mechanical Products) Model 7707 standard flexible couplings for all other piping.

.3 Gaskets shall be EPDM compound, rated -34º C to +110º C (-30º F to +230º F).

.2 **Black Steel – Screwed Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.3 **Black Steel – Welded Joint:** Schedule 40, mild black carbon steel, Grade B, ASTM A53, mill or site beveled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible, and welded joints.

.4 **Black Steel – Press Joint**: Schedule 40, mild black carbon steel, Grade B, ASTM A53, complete with carbon steel fittings conforming to the performance criteria of IAPMO PS 117 and ASME B31.9. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. System to be rated to a minimum pressure of 1379 kPa (200 psi) and a temperature range of -18ºC to 120ºC (0F to 250ºF).

.1 Acceptable Manufacturers

.1 Viega LLC. “MegaPress”

.2 Apollo Valves “PowerPress”

.5 **Copper – Solder Joint**: Type “L” hard drawn seamless copper to ASTM B88, plain ends. All joints made with 95-5 tin-antimony or tin-silver solder.

.6 **Copper – Press Joint:** Type “L” hard drawn seamless copper to ASTM B88, complete with wrought copper press fittings (ANSI/ASME B16.22) or cast copper alloy press fittings (ANSI/ASME B16.18) conforming to the performance criteria of IAPMO PS 117. Sealing elements for pressing fittings shall be EPDM and shall be factory installed or supplied by fitting manufacturer. Press fittings shall feature a design leakage path, assuring leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. System to be rated to a minimum pressure of 1379 kPa (200 psi) and a temperature range of -18ºC to 120ºC (0F to 250ºF).

.1 Acceptable Manufacturers

.1 Viega LLC. “ProPress”

.2 Apollo Valves “Press”

.3 Nibco Inc. “Press Fittings”

2.2 PIPING UNIONS

.1 Screwed Steel Piping: Dart Union Co. of Canada Ltd. or approved equivalent malleable iron, ground joint, brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260ºC (500ºF).

.2 Press Steel Piping: Viega MegaPress union or approved equivalent carbon steel press connection with a minimum pressure rating of 1379 kPa (200 psi) at a temperature range -18ºC to 120ºC (0F to 250ºF).

.3 Welded Steel Piping: Forged carbon steel slip-on type raised face welding flange unions in accordance with ASTM A105, 150 lb. Class.

3 Execution

3.1 HYDRONIC PIPING MATERIAL AND JOINT TYPES:

.1 Heating water piping, Chilled water piping and Glycol water piping; unless otherwise specified, is to be as follows:

.1 For pipe up to 50 mm (2 in.) diameter, Schedule 40 **Black Steel – Screwed Joint.** As an alternative Schedule 40 **Black Steel – Press Joint**, Type “L” **Copper - Press Joint,** and Type “L” **Copper – Solder Joint** may be used.

.2 For short, individual branch connections to heating/cooling equipment, when pipe diameters are less than 25 mm (1 in.) and when working pressures are below 1034 kPa (150 psi) **Hydronic PEX** piping may be used as an acceptable alternative.

3.2 GENERAL PIPING INSTALLATION REQUIREMENTS

.1 Slope all piping so that it can be completely drained. Horizontal piping mains to be sloped to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Branch supply and return piping connections to be sloped towards equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation of air vents.

.2 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the work specified in Section 25 05 00 – Building Automation System.

.3 Connect equipment provided as part of the Work of other Sections with piping as indicated in and/or required by the Contract Drawings. Refer to pipe connection details on Drawings.

.4 Unless otherwise specified in the Contract Documents, locate and arrange horizontal pipes above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.

.5 Unless otherwise specified in the Contract Documents, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.

.6 Install all pipes and ducts parallel to building lines (all piping shall run parallel with closest wall).

.7 Piping in walk-in pipe spaces shall be installed as close to one wall as possible.

.8 Neatly group and arrange all exposed work.

.9 Locate all valves and any other equipment which will or may need maintenance or repaired in accessible spaces, equipment shall be easily accessible from access doors. Where valves and similar piping accessories occur in vertical service spaces (ie. in shafts, pipe spaces or partitions) locate the accessories at the floor level.

.10 Make all connections between pipes of different materials using proper approved adapters. Provide proper dielectric unions in all connections between copper pipe and ferrous pipe or equipment. Dielectric fitting to conform to ASTM F492 complete with thermoplastic liner.

.11 Ensure that the equipment and material manufacturers' installation instructions are followed unless otherwise specified in this Section or on the Drawings, and unless such instructions contradict governing codes and regulations.

.12 Carefully clean all pipes and fittings prior to installation. Temporarily cap or plug ends of pipes and equipment which are open and exposed during construction.

.13 Install piping which is to be insulated so that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the pipe, except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.

.14 Inspect surfaces and structure prepared by other trades before performing the work of this Section. Verify that surfaces or the structure to receive the work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of the work shall constitute the Contractor’s acceptance of such surfaces as being satisfactory.

3.3 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream all piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads, unless otherwise specified in the Contract Documents, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two pipe threads are to remain exposed.

.4 Unless otherwise specified in the Contract Documents, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.

.5 Install mechanical joint fittings and couplings in accordance with the manufacturer's instructions.

.6 If grooved fittings and couplings are used, ensure that all valves and piping accessories are suitable. Grooves shall be rolled. Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to the manufacturer's instructions with respect to pipe grooving, support, anchoring and guiding the grooved piping system. Note that all grooved end piping system products shall be supplied by a single manufacturer who is operating to an ISO 9001 program.

3.4 PRESSURE TESTS

.1 Conform to requirements of Section 20 30 01 – Pressure Testing, Cleaning and Filling.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 21 13 – Hydronic Piping.

.3 Section 23 21 23 – Hydronic Pumps.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ANSI/ASME B16.4, Cast Iron Threaded Fittings, Classes 125 and 250.

.6 ANSI/ASNE B31.9, Building Services Piping.

.2 ASTM International Inc.

.1 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications.

.2 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.3 ASTM A743/A743A, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

.4 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.5 ASTM B283, Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).

.6 ASTM F1969, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.2 CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

.3 CAN/ULC-S115, Standard Method of Fire Tests of Firestop Systems

.4 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Product Data:

.1 Provide the manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHIMS MSDS – Materials Safety Data Sheets.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed to practice in the Province of Ontario, Canada.

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

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 SHUT-OFF VALVES

.1 Ball Type for nominal pipe sizes from 12 to 50 mm (½" to 2"): Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded or press joint ends, and removable lever handle. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Kitz Corp. Code 58

.2 Toyo Valve Co. Fig. 5044A

.3 Nibco T-585-70

.4 Watts Water Technologies (Canada) Inc. #FBV-3C

.5 Equivalent manufacturers: Apollo Valves, Viega, Victaulic, Tyco Grinnell, M.A Stewart & Sons, NCI.

.2 Butterfly Type for nominal pipe sizes 65 mm (2-1/2") and larger: Ductile iron, lug body style or grooved, 1200 kPa (175 psi) rated, butterfly valve, each complete with a neck to permit 50 mm (2 inches) of insulation above the flange, an EPDM seat, aluminum bronze or stainless steel disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 100 mm (4 inch) diameter, and a handwheel and gear type operator for valves larger than 100 mm (4 inch) diameter and each suitable for bubble-tight dead end service with the valve in position and either side of the connecting piping removed. Where piping is insulated provide stem extensions to clear insulation. Acceptable products are:

.1 Kitz Corp. Code 6122EL or 6122EG

.2 Toyo Valve Co. #918 BESL-2 or 918 BESG-2

.3 Nibco # LD-2000

.4 Equivalent manufacturers: Apollo Valves, Viega, Victaulic, Tyco Grinnell, M.A. Stewart & Sons, DeZurik of Canada Ltd.

2.2 SWING CHECK VALVES

.1 Bronze – Screwed: Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends. Acceptable products are:

.1 Kitz Corp. Code No. 22

.2 Toyo Valve Co. Fig. 236

.3 Nibco #T-413

.4 Equivalent manufacturers: Apollo Valves, Watts Water Technologies (Canada) Inc.

.2 Steel – Grooved Ends: Victaulic Co. of Canada Ltd. Series 716 "Vic-Check", Tyco Grinnell Model 590, Gruvlok Series 7811 or Shurjoint #SJ-900 grooved end carbon steel check valves suitable for mounting horizontally or vertically.

.3 Cast Iron –Flanged: Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover and flanged ends as required. Acceptable products are:

.1 Kitz Corp. Code No. 78

.2 Toyo Valve Co. Fig. 435A

.3 Nibco #F-918-B

.4 Equivalent manufacturers: Apollo Valves, Watts Water Technologies (Canada) Inc.

2.3 VERTICAL LIFT CHECK VALVES

.1 Class 125, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc. Acceptable products are:

.1 Kitz Corp. Code No. 36

.2 Toyo Valve Co. Fig. 231

.3 Nibco #T-480

.4 Watts Water Technologies (Canada) Inc. #LF600

.5 Equivalent manufacturers: Apollo Valves, Viega, M.A. Steward & Sons.

2.4 WAFER CHECK VALVES

.1 Threaded lug body type, full bore, Class 125, 1380 kPa (200 psi) rated at 38 degrees C (100 degrees F), non-slam dual wafer check valves, each complete with a carbon steel or cast iron body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe. Acceptable products are:

.1 Nibco #W-920

.2 The Metraflex Co. Style CVXX

.3 Watts Water Technologies (Canada) Inc. Series #ICV-125

.4 Equivalent manufacturers: Crane Valve Co, Mueller Steam Specialty, Gulf Valve Co.

2.5 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (3/4-inch) diameter straight pattern full port bronze or brass ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (3/4-inch) diameter garden hose, and a cap and chain. Acceptable products are:

.1 Kitz Corp. Code No. 68AC

.2 Toyo Valve Co. Ltd. Fig. 5046

.3 Nibco # T-585-70-HC

.4 Watts Regulator #B-6000-CC

.5 Equivalent manufacturers: Apollo Valves.

2.6 CIRCUIT BALANCING VALVES

.1 Valves 12 to 50 mm (1/2 to 2 in.) 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off. Valves shall provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360 degree handwheel turns. 90 degree 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, 6.35 mm (1/4 in.) threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin.

.2 Valves 65 to 300 mm (2-1/2 to 12 in.) 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off. Valves shall provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360 degree handwheel turns. 90 degree 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body shall be either cast iron with integrated cast iron flanges or ductile iron with industrial standard grooved ends. Valve stem and plug disc shall be bronze with ergonomically designed handwheel that permits multi-turn adjustments. Sizes 65 and 75 mm (2-1/2 and 3 in.) – 5 turns; sizes 100 mm to 150 mm (4 to 6 in.) – 6 turns; sizes 200 and 250 mm (8 and 10 in.) – 12 turns and size 300 mm (12 in.) – 14 turns. Flange adapters shall be supplied, to prevent rotation.

.3 Acceptable products are:

.1 Armstrong Fluid Technology. Series "CBV" screwed, flanged or grooved

.2 Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end

.3 Tyco Grinnell Series CB800 screwed, flanged, or grooved end

.4 Gruvlok series "GBV" screwed or grooved

.5 RWV #9517 screwed or 9474P flanged

2.7 AUTOMATIC FLOW LIMITING VALVES

.1 Valves 12 to 50 mm (1/2 to 2 in.) 'Y' pattern, pressure independent, cartridges shall be stainless steel with a spring loaded cup designed to dynamically absorb pressure fluctuations resulting from changes in system conditions due to varying heating/cooling loads. Flow shall be controlled within+/- 5% of the design flow, with a WOG rating of no less than 300 psi. Valves shall arrive fully assembled and include:

.1 **Cartridge:** AISI Type 304 stainless steel cartridge complete with an AISI Type 17-7 PH stainless steel spring.

.2 **Strainer:** 20 mesh stainless steel.

.3 **Body Material:** 12 to 40 mm (1/2 to 1-1/2 in.) to be constructed of forged brass (ASTM B283), 40 to 50 mm (1/2 to 1-1/2 in.) to be constructed of cast brass.

.4 **End Connections:** Brass – NPT, Sweat or Press joint.

.5 **Ball Valve Seals:** Teflon

.6 **Union Seal:** EPDM O-Ring

.7 **Body Tappings:** Port 1 and 2 shall be combination P/T test valves and manual air vent; Port 4 shall be a drain.

.8 **Ball Valve:** Nickel-plated brass ball.

.2 Acceptable manufacturers:

.1 Griswold Controls LLC.

.2 Hays Fluid Controls.

.3 Bell & Gossett (Xylem Inc.)

2.8 PRESSURE RELIEF VALVES:

.1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1035 kPa (150 psi) rated pressure relief valves, each capable of relieving the full output of the equipment it is associated with, and each factory set at the pressure as noted in Part 3 of this specification. Acceptable products are:

.1 Bell & Gossett (Xylem Inc.), 3301/4100, or 790/1170

.2 Spirax Sarco Ltd. SVI Series

.3 Watts Water Technologies (Canada) Inc. 174A or 740

.4 Equivalent manufacturers: Dresser Industries, McDonnell & Miller, Conbraco, Kunkel.

2.9 AIR VENTS

.1 Manual Air Vents: Apollo Valves (Johnson Paterson) 27-Series or approved equivalent, 3.2 mm (1/8-inch) dia. manual valve with key.

.2 Automatic Air Vents: Float actuated air vents, each complete with a cast iron body and a cap, a stainless steel float assembly and seat, and an EPDM valve head. Acceptable products are:

.1 Spirax Sarco Ltd., Type 13 WS for system working pressures to 1035 kPa (150 psi), 13WH for system working pressures greater than 1035 kPa (150 psi)

.2 Armstrong International, No. 1-AV

2.10 STRAINERS

.1 Cast iron or bronze wye shaped strainers, minimum 860 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2 inch) diameter and larger, a blowdown pipe connection tapping. Acceptable products are:

.1 Kitz Fig. 15 screwed or Fig. 80 flanged

.2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged

.3 Watts Water Technologies (Canada) Inc. #77SCI

.4 Victaulic Co. of Canada Style 732 "Vic-Strainer"

.5 Equivalent manufacturers: Spirax Sarco Ltd., Muller Steam Specialties, Tyco Grinnell, Gruvlok, Shurjoint.

2.11 PIPING ALIGNMENT GUIDES

.1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit the pipe size and the pipe insulation thickness. Acceptable products are:

.1 Mason Industries Inc. Series SPG.

.2 Hyspan Precision Products, Series 9500.

.3 The Metraflex Co. Style IV.

.4 Equivalent manufacturers: Senior Flextronics Inc., E. Myatt & Co, Anvil Inc., Empire Tool & Mfg. Inc.

2.12 PIPE ANCHORS

.1 Welded structural black steel anchors of a size and type to securely anchor the pipe at the point shown. Each anchor is to be designed and detailed by a professional structural engineer registered in the Province of Ontario. Submit anchor shop drawings, stamped by the design engineer, for review.

3 Execution

3.1 INSTALLATION OF SHUT-OFF VALVES

.1 Provide shut-off valves in piping connections to equipment, on branch line connections to mains, on each piping riser, at 30 m (100 foot) intervals on main lines, and wherever else indicated on the Drawings.

.2 Valves in piping to and including 50 mm (2 inch) diameter are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified.

.3 Locate all valves so that they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

3.2 INSTALLATION OF CHECK VALVES

.1 Provide a check valve in the discharge piping of every pump, and elsewhere in piping where shown on the Drawings.

.2 In horizontal piping swing or vertical lift check valves shall be used. Where check valves are required in vertical piping, ensure that they are suitable in all respects for the application; vertical lift check valves shall be used wherever possible.

.3 Wafer check valves may be used as an alternative to swing check valves when necessary.

.4 Note that check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory supplied with the pump.

3.3 INSTALLATION OF DRAIN VALVES

.1 Provide a drain valve at the base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

3.4 INSTALLATION OF CIRCUIT BALANCING VALVES

.1 Provide circuit balancing valves in piping connections to all equipment (including but not limited to coils, heat exchangers (both circuits), boilers, unit heaters, radiation, radiant ceiling panels, pumps, 3-way control valves (2 ports), by-pass around control valves, etc.).

.2 Confirm locations with the consultant prior to installation.

3.5 INSTALLATION OF AUTOMATIC FLOW LIMITING VALVES

.1 Provide automatic flow limiting valves, as an alternative to circuit balancing valves and where required by these specifications and the drawings.

.2 Confirm locations with the consultant prior to installation.

3.6 INSTALLATION OF PRESSURE RELIEF VALVES

.1 Provide factory set pressure relief valves in all closed loop HVAC systems wherever else shown on the drawings.

.1 For glycol-filled systems, pipe the discharge of each relief valve to the glycol make-up package storage tank unless otherwise shown or specified.

.2 Pressure relief valve settings shall be selected based on the following order of priority:

.1 As noted on the drawings.

.2 The relief pressure specified for the loop's expansion tank.

.3 10% lower than the component in the system with the lowest pressure rating.

.3 Confirm all pressure relief valve settings with the consultant prior to purchase and installation.

3.7 INSTALLATION OF AIR VENTS

.1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Install vents in accordance with the Drawing detail(s).

3.8 INSTALLATION OF STRAINERS

.1 Provide strainers in piping where shown.

.2 Locate strainers so that baskets are easily accessible and removable.

.3 Clean strainer baskets after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.9 INSTALLATION OF PIPING ANCHORS

.1 Provide anchors to secure pipework to the structure where shown and/or specified.

.2 Anchors are to be in accordance with reviewed shop drawings.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 33 00 – Air Duct Accessories.

.3 Section 23 36 00 – Variable Air Volume Terminal Units.

.4 Section 23 36 00 – Diffusers, Registers, and Grilles.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers International (ASME)

.1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 American Society for Testing and Materials International (ASTM)

.1 A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat- Resisting Steel Plate, Sheet, and Strip.

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

.4 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.5 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

.2 HVAC Air Duct Leakage Test Manual.

.4 Canadian Standards Association (CSA):

.1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.

.5 Underwriters’ Laboratories, Inc. (UL)

.1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.

.6 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Provide Submittals in accordance with Section 01 33 00 Submittal Requirements.

.2 Shop Drawings:

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

.2 Duct Construction: Provide the manufacturer's product literature of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.

.3 Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.

.3 Test Data:

.1 Submit duct leakage test data prior to ductwork being covered from view.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 DUCTWORK

.1 **General:** All ductwork shall be designed, constructed, supported and sealed in accordance with SMACNA HVAC Duct Construction Standards and pressure classifications, unless otherwise noted in the Contract Documents.

.2 **Aluminum - Rectangular:** Construction conforming to ASTM Standard B209, (Alloy 3003 Temper H14 aluminum), shop or factory fabricated, water-tight, with metal gauges and fabrication in accordance with SMACNA Rectangular HVAC Duct Construction Standards Metal and Flexible to suit the duct configuration, a duct pressure class designation (positive and negative as applicable) as described in Part 3 Execution, and Type 304 stainless steel support hardware.

.3 **Aluminum - Round:** Helically wound "RL-1" flat-lock seam construction conforming to ASTM Standard B209 (Alloy 3003-H14 aluminum), shop or factory fabricated, water-tight, with metal gauges and fabrication in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Construction shall suit the duct configuration and a duct pressure class designation (positive and negative) as described in Part 3 Execution. Standard elbows shall have 1.5 centerline radius (other radii and vaned elbows shall be available as needed) with stainless steel rivets and silicone sealant. Fitting joints and connections shall be either slip fit, gasketed or flanged. Use aluminum fasteners/ support hardware.

.4 **Flexible Metallic - Uninsulated:** SMACNA form "M-UN" spirally wound, corrugated and mechanically locked 3003 aluminum strip forming a continuous airtight tri-lock seam, tested for air velocities up to 20.3 m/s (4000 FPM) and operating pressures from 1.5kPa (6" w.g.) positive to 0.25kPa (1" w.g.) negative. ULC-S110 Listed Class 1 Air Duct Connector with a flame spread and smoke developed rating of less than 25/50.

.1 Acceptable manufacturers are:

.1 Peppertree Air Solutions Inc.

.2 Westaflex Inc.

.5 **Flexible Metallic - Insulated:** SMACNA form "M-I". Aluminum core as specified above, factory wrapped in Owens Corning Greenguard Certified R4.2 insulation with installed wall thickness of not less than 1.125" and sleeved by a flame retardant polyethylene vapour barrier. Approved for air velocities up to 20.3 m/s (4000 FPM) and operating pressures from 1.5kPa (6" w.g.) positive to 0.25kPa (1" w.g.) negative. ULC-S110 Listed Class 1 Air Duct Connector with a flame spread and smoke developed rating of less than 25/50.

.1 Acceptable manufacturers are:

.1 Peppertree Air Solutions Inc.

.2 Westaflex Inc.

2.2 CASING AND PLENUM MATERIAL

.1 Unless otherwise specified in the Contract Documents, casing and plenum material shall be the same as the connecting duct material. If connecting duct is galvanized steel the galvanizing shall be G90.

.2 Unless otherwise specified in the Contract Documents, each plenum shall have a hinged access door and each intake plenum shall have a watertight drainage pan and 25mm drainage port.

2.3 DUCT SYSTEM JOINT SEALANT

.1 Ductmate "PROseal" High Velocity Duct Sealant or approved equivalent ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush or gun applied, with a maximum flame spread rating of 0 and smoke developed rating of 0.

2.4 ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Peppertree Air Solutions Inc. "SPIN-ON" or approved equivalent G60 or G90 galvanized steel, flared notched and beaded round duct take-off collar complete with damper and associated hardware (including spring loaded damper clip, threaded damper clip, locking wing-nut and aluminum handle) to be installed in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible

.1 Acceptable manufacturers are:

.1 Peppertree Air Solutions Inc.

.2 Westaflex Inc.

3 Execution

3.1 FABRICATION OF DUCTWORK

.1 Unless otherwise specified in the Contract Documents, construct, install and seal ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designations positive and negative as listed below. Construct ductwork so the manufacturer's gauge markings are external. Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting ductwork. Unless otherwise shown or specified, hang or support ductwork from the structure only. Where the ductwork is insulated, supports and hangers shall be of sufficient length to allow the insulation and covering to pass between the hangers unbroken.

.2 The following low pressure and medium pressure construction is based on the SMACNA method of construction, and gives a minimum standard of construction. Proposed alternatives are acceptable provided they follow the SMACNA HVAC Duct Construction Standards. Submit alternatives for review prior to fabrication.

.3 **Low Pressure Rectangular Ducts:** For systems less than 0.5 kPa (2” w.g.) static pressure and under 10.2 m/s (2000 fpm) velocity. Construct low pressure rectangular ducts as follows in Table 2:

.1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.

.2 Locate bracings mid-way between joints.

.3 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.

Table 1: Low Pressure Rectangular Duct Construction

Max. Duct Dimension	Sheet Metal (ga)	Transverse Joint Connection and Bracing
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing

.4 **Low and medium pressure round ducts:** For systems below 1.5 kPa (6 in.) static pressure. Use products specified in Part 2 - Products wherever possible, otherwise construct low and medium pressure ducts as follows:

.1 Round ducts up to 750 mm (30 in.) dia. shall be factory fabricated, helically wound galvanized iron strips with spiral lock seam as follows. Join with galvanized iron coupling sleeves or conduit fittings of welded construction:

Table 2: Low and Medium Pressure Round Duct Construction (Up to 750mm)

Diameter	Strip Metal (ga)	Strip Joint	Girth Joint
Up to 200 mm (8 in.)	26	100 mm (4 in.)	50 mm (2 in.) long slip
225 mm to 550 mm (9 in. to 22 in.)	24	100 mm (4 in.)	50 mm (2 in.) long slip
575 mm to 750 mm (23 in. to 30 in.)	22	150 mm (6 in.)	100 mm (4 in.) long slip

.5 All ductwork shall be sealed in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings.

3.2 GENERAL INSTALLATION OF DUCTWORK

.1 **Aluminium – Low Pressure:** Install low pressure aluminium ductwork in the following areas noted below.

.1 Lockers shower/ washroom exhaust air ductwork (ERV).

.2 Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.

.3 Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.

.4 Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.

.5 Where the reinforcing of ductwork is required use of tie rods is the preferable method.

.6 For insulated ductwork, size the hanger support to suit the insulated duct and install the hanger or support on the outside of the insulation and covering.

.7 **Rectangular Duct Support Inside Building:** Coordinate with discipline responsible for Section 20 05 29 - Hangers and Supports to support horizontal rectangular ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with galvanized steel channels and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20").

.8 **Round and Flat Oval Duct Support Inside Building:** Coordinate with discipline responsible for Section 20 05 29 - Hangers and Supports to support round and flat oval ducts inside the building in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Unless otherwise specified in the Contract Documents, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.

.9 **Watertight Ductwork:** Where watertight horizontal ductwork is required inside the building, construct the ducts without bottom longitudinal seams. Solder or weld the joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide the drain points. Provide watertight ductwork for:

.1 Lockers shower/ washroom exhaust air ductwork (ERV)

.2 Wherever else shown on the Drawings.

.10 **Leakage Testing:** Leakage testing shall be performed in accordance with the ANSI/SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012 and shall be witnessed by the Consultant.

.1 Acceptable Leakage shall be calculated based on the following criteria:

.1 Rectangular metal ductwork - Leakage Class 6 (cfm/100ft^2 @ 1” w.g.)

.2 Round metal ductwork - Leakage Class 3 (cfm/100ft^2 @ 1” w.g.)

.3 No less than 25% of all ductwork shall be tested at the rated static pressure of the supply or exhaust duct. If the test result is “pass” then no additional testing shall be required. If the test result is “fail” then additional leak testing shall be performed on 50% of all ductwork. If the test result is “pass” then no additional testing shall be required. If the second test result is “fail” then all 100% of ductwork shall be tested.

.4 All ductwork shall be tested prior to the installation of dampers, grilles, registers, coils, openings, etc that could cause a failure in the pressure test. Sections of ductwork shall be completely replaced where this occurs prior to the passing of the leakage testing.

.5 Positive pressure leakage testing is acceptable for negative pressure ductwork.

.6 Leakage factor to be calculated based on surface area of metal contained within the section and the specified test pressure using ANSI/SMACNA HVAC Air Duct Leakage Test Manual Second Edition – 2012 Fig’s 5-1 & 5-1L.

.7 To be certified by the same testing, adjusting, and balancing agency approved by the Consultant to undertake testing, adjusting, and balancing on this project.

.11 **Application of Sealants:** Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed, apply neat uniform lines of sealant. Randomly brushed, sloppy

looking sealant applications will be rejected and must be repaired or replaced with a neat application of the sealant. For Seal Class A apply the sealant on the interior of the duct.

3.3 INSTALLATION OF ALUMINUM DUCTWORK

.1 Wherever bare aluminum ductwork comes in contact with ferrous metal or copper, paint the ferrous metal or copper surface with a heavy, 100% covering coat of zinc chromate paint, asphalt paint or otherwise isolate direct contact with the bare aluminum.

.2 Slope branch aluminum ductwork down to mains and/or the riser wherever possible. Provide a drain point in the bottom of the riser, and at all other low points. Where it is not possible to slope aluminum branch ductwork down to mains or risers, slope the ductwork down to exhaust grilles.

.3 Refer to "Commentary on Aluminium Ducts" of SMACNA HVAC Duct Construction Standards Metal and Flexible, however, do not use drive and S cleats for joining waterproof aluminum ductwork. Use the following SMACNA joining methods:

.1 T-21 - welded flange

.2 T-22 - companion angle and gasket

.3 T-24A flanged

.4 Keep longitudinal joints at the top surface of horizontal runs. Provide proper transverse supports to prevent deflection. Ensure that the duct is rigid.

.5 When mastic is used for sealing such as sealing longitudinal joints, apply the mastic to both surfaces before they are mated. When dry, apply mastic again for a water-tight seal.

3.4 INSTALLATION OF FLEXIBLE DUCTWORK

.1 Provide maximum 1.5 m (5') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers.

.2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.3 Install flexible ducts as straight as possible and support in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.4 Do not penetrate fire barriers with flexible duct.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 30 00 – HVAC Ducts and Plenums.

.3 Section 23 34 00 – HVAC Fans.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)

.1 ASHRAE Standard 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.2 ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 American Society for Testing and Materials International (ASTM)

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

.2 A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

.3 B209/B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 HVAC Duct Construction Standards - Metal and Flexible.

.2 HVAC Air Duct Leakage Test Manual.

.4 Canadian Standards Association (CSA):

.1 CSA/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.2 CAN/ULC-S110, Standard Methods of Test For Air Ducts.

.5 Underwriters’ Laboratories, Inc. (UL)

.1 UL 181, Standard for Safety Factory-Made Air Ducts and Connectors.

.6 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Shop Drawings:

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

.2 Submit shop drawings for all equipment in this Section.

.2 Test Data:

.1 Submit duct leakage test data prior to ductwork being covered from view.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 SPLITTER DAMPERS

.1 Minimum 0.95 mm thick (20 ga) damper blade constructed of the same material as the duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware DynAir Inc. #Q-50 "DYN-A-QUAP Single Shear" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin or approved equivalent.

2.2 AIR TURNING VANES

.1 For square elbows – Ductmate "PROrail" multiple-radius turning vanes, interconnected with bars, adequately reinforced to suit the pressure and velocity of the system, constructed of the same material as the duct they are associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections - air extractor type, each equipped with a matching bottom operated 90 degree opposed blade volume control damper, constructed of the same material as the duct it is associated with, and in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.3 MANUAL BALANCING (VOLUME) DAMPERS

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of the same material as the connecting ductwork unless otherwise specified in the Contract Documents (where aluminum is not available use stainless steel), each designed to maintain the internal free area of the connecting duct, and each complete with:

.1 A round shaft extension through the frame;

.2 Non-stick, non-corrosive bronze bearings for rectangular dampers, flange, non-stick, non-corrosive oilite bronze bearings for round dampers;

.3 No blade stops;

.4 Linkage for multiple blade dampers;

.5 Nailor # HL2 locking hand quadrant damper operator with 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Model #1810FDB-(GLV or SS)-DSB-BO-HLF, Spinnaker Industries Inc Model SK-1810-FF-16-CL-CB or Ruskin Model CD80VG1 (GLV or SS), maximum size 1.2m x 1.2m (4' x 4') for a single damper, and equipped with a 1.613 mm thick (16 ga) flanged type frame with 40 mm (1½") bolt hole centres, non-stick, non-corrosive bronze bearings, no sill and linkage out of air stream.

.3 Round Dampers: Nailor Model #1090 BO FMS, galvanized or stainless steel, non-stick, non-corrosive oilite bronze bearings, full perimeter blade stop, maximum 1.2 m (4') diameter equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of the same material as the damper and designed for tight and secure mounting of the individual dampers.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.

.2 Greenheck Fan Corporation

.3 E.H. Price Ltd.

.4 Ruskin Company

2.4 CONTROL DAMPERS:

.1 Motorized dampers shall be sized as indicated. Maximum damper section shall be 1200 mm x 1500 mm (48 in. x 60 in.). For dampers larger than the section maximum, use an assembly of multiple, equally sized sections.

.2 Two-Position motorized dampers shall be parallel blade. Modulating motorized dampers shall be opposed blade. Exception: Parallel blade dampers may be used for return air and bypass application.

.3 Frames shall be constructed of extruded aluminum.

.4 Provide in duct mounting dampers.

.5 Blades shall be extruded aluminum airfoil type.

.6 Blade seals shall be extruded EPDM. Frame seals shall be extruded silicone. Seals shall be secured in an integral slot within the aluminum extrusions. Blade and frame seals shall be mechanically fastened to eliminate shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals shall not be acceptable.

.7 Maintenance free bearings shall be composed of a Celcon inner bearing fixed to an aluminum blade pivot pin, rotating within a polycarbonate outer bearing inserted into the frame. No metal to metal or metal to plastic contact.

.8 Drive rods, U bolt fasteners and retaining nuts shall be corrosion resistant zinc plated steel.

.9 All linkage hardware shall be installed on the frame side. All linkage crank arm and rod hardware parts shall be constructed of aluminum.

.10 Dampers shall be designed for operating in temperatures between -40ºC to 100ºC (-40ºF to 212ºF).

.11 Leakage shall not exceed 15 l/s/m2 (2.95 cfm/ft2) against 250 Pa (0.036 psi) of differential pressure across fully closed damper when tested to AMCA Standard 511.

.12 Acceptable manufacturers are:

.1 T.A. Morrison & Co. Inc

.2 Nailor Industries Inc.

.3 Greenheck Fan Corporation

.4 E.H. Price Ltd.

.5 Ruskin Company.

.6 Ventex Inc.

2.5 FUSIBLE LINK (FIRE) DAMPERS

.1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified in the Contract Documents) fusible link dampers, ULC classified to Standard CAN/ULC-S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1.5 hour or 3 hour rated as required by the Contract Documents, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, an integral steel sleeve c/w

retaining angles, and, unless otherwise specified in the Contract Documents, a 74ºC (165ºF) rated standard fusible link.

.2 Fusible link dampers shall be type "B" or type "C" (as required) with the folded curtain blade out of the air stream except where damper size or location requires the use of type "A" dampers with the curtain blade in the air stream.

.3 Fusible link dynamic types shall consist of the following:

.1 Dynamic curtain type shall not exceed a single section as follows:

.1 Horizontal mount Type "A": 610 mm wide x 610 mm high (24" wide x 24" high) Nailor Model D0114 c/w factory sleeve.

.2 Vertical mount Type "A": 914 mm wide x 914 mm high (36" wide x 36" high) Nailor Model D0114 c/w factory sleeve.

.3 Horizontal Type "B": 533 mm wide x 610 mm high (24" wide x 21" high) Nailor Model D0124 c/w factory sleeve

.4 Horizontal Type "B": 914 mm wide x 813 mm high (36" wide x 32" high) Nailor Model D0124 c/w factory sleeve.

.5 Type "A" dampers with folded blades in the airstream are only acceptable with the prior approval of the consultant

.2 Dynamic airfoil muli-blade for sizes above 600 mm wide x 533 mm high (24" wide x 21" high):

.1 Vertical mount Type "A" shall not exceed 1829 mm wide x 1219 mm high (72" wide x 48" high) or 914 mm high x 2438 mm wide (36" wide x 96" high) maximum consisting of two sections. Nailor Industries Inc. Model D1201 c/w factory sleeve

.2 Horizontal mount Type "A" not to exceed 1626 mm wide x 1219 mm high (64" wide x 48"high) or 813 mm wide x 2438 mm high (32" wide x 96" high) maximum consisting of two sections. Nailor Industries Inc. Model D1201 c/w factory sleeve.

.3 Dampers with duct heights less than 203 mm (8") require Type B Nailor Industries Inc. Model D1202 c/w factory sleeve or Type "C".

.4 Type "A" dampers with folded blades in the airstream are only acceptable with the prior approval of the consultant

.4 Fusible link dampers in ductwork other than galvanized steel shall be as specified above but constructed of type 316 stainless steel. Nailor Model D1201SS c/w factory sleeve:

.1 Type "A" single section minimum 203 mm wide x 203 mm high (8" wide x 8" high) or 914 mm high x 1219 mm wide (36" x 48") maximum single section. Vertical mount only. Nailor Model D1201SS c/w factory sleeve.

.2 Type "A" multi section assembly 203 mm wide x 203 mm high (72" wide x 96" high) or 914 mm wide x 1219 mm high (144"wide x 48" high) vertical mount only. Nailor Model D1201SS c/w factory sleeve.

.5 Acceptable manufacturers are:

.1 Nailor Industries Inc.

.2 Greenheck Fan Corporation

.3 E.H. Price Ltd.

.4 Ruskin Company

2.6 FLEXIBLE CONNECTION MATERIAL

.1 Waterproof indoor-outdoor woven fibreglass fabric coated on both sides with a specially compounded synthetic rubber, off-white in colour, flexible material between the fan discharge and the casing opening, with spring thrust restraints secured to welded brackets on the fan housing and by steel rods though the fan casing with a steel back-up plate. Acceptable products are:

.1 Duro Dyne Canada Inc. "DUROLON"

.2 DynAir Inc. "HYPALON"

.2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber to produce a material with an operating temperature range of from -50ºC to 260ºC (-60ºF to 500ºF). Acceptable products are:

.1 Duro Dyne Canada Inc. "Thermofab"

.2 DynAir Inc. "SILICON HI-T"

2.7 DUCT ACCESS DOORS

.1 Nailor Model Series 0800 flat oval access doors or approved equivalent complete with safety chain. Frame shall be of flat oval design, double flange frame mounting type M-1, die-formed of minimum 0.85 mm (22 ga) galvanized steel. Door shall be die-formed of minimum 0.85 mm (22 ga) galvanized steel and be of double skin construction with 25 mm (1") of insulation fully enclosed within and an integral bulb type seal fastened to the door with sizes suitable in all respects for the purpose for which they are provided, and, unless otherwise specified in the Contract Documents, constructed of the same material as the duct they are associated with. Manufacturer shall submit leakage data tested to a minimum of 2 kPa (8" w.g.).

.2 Acceptable manufacturers are:

.1 Nailor Industries Inc.

.2 Ductmate Industries Inc.

.3 Ruskin Company

2.8 DUCTWORK DRAIN POINT

.1 Ductmate Canada Ltd. "Moisture Drain", or approved equivalent 20 mm (3/4") in diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.9 INSTRUMENT TEST PORTS

.1 Duro Dyne of Canada Ltd. #TH1 or #IP2 (to suit insulation thickness where applicable) or approved equivalent gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.10 FILTERS FOR COMMISSIONING

.1 Supplied with each air handling unit as follows:

.1 Construction filter - Camfil Farr "CG-3000" 25 mm (1") thick, high-loft fibreglass (white/yellow), MERV 8, synthetic roll media secured in place in the filter section prior to shipping.

3 Execution

3.1 INSTALLATION OF SPLITTER DAMPERS

.1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on the Drawings. Install splitter dampers so they

cannot vibrate and rattle and so that the damper operation mechanisms are in an easily accessible and operable location.

3.2 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in all ductwork elbows (supply, exhaust, return) where due to site installation routing and duct elbow radius of less than one and a half (1½) times width (smooth radius elbows with a R/W of 1.5) is not possible, turning vanes and splitter vanes shall be in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified in the Contract Documents.

3.3 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers in all open end ductwork, in all supply and return air duct mains, in all branch ducts, at each individual grille, register, diffuser and wherever else shown and/or specified in the Contract Documents.

.2 Install the dampers so that the operating mechanism is accessible and positioned for easy operation, and so that the dampers cannot move or rattle.

.3 Where a duct for which a balancing damper is required has dimensions larger than the dimensions of the maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit.

3.4 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers where shown on the Drawings.

.2 Install and secure the dampers so that they cannot move or rattle.

3.5 INSTALLATION OF CONTROL DAMPERS

.1 Provide control dampers for all exhaust fans, exhaust air louvres, air intake louvres, and wherever else shown on the Drawings.

.2 Install dampers in accordance with manufacturer’s Installation Instructions.

.3 Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access. The general contractor shall furnish any access doors required in walls, ceilings, or other general building construction.

.4 Install dampers square and free from racking.

.5 The installing contractor shall provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.

.6 Do not compress or stretch the damper frame into the duct or opening.

.7 Attach multiple damper section assemblies together in accordance with manufacturer’s instructions. Install support mullions as reinforcement between assemblies as required.

.8 Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft

.9 Install connections to actuators as specified in Section 25 00 00.

3.6 INSTALLATION OF FUSIBLE LINK (FIRE) DAMPERS

.1 Provide fusible link dampers where shown and/or specified on the Drawings. Ensure that the damper rating (1.5 or 3 hr.) is suitable for the fire barrier it is associated with.

.2 Install dampers with retaining angles on all four sides of the sleeve on both sides of the damper and connect with ductwork in accordance with the damper manufacturer's instructions and details to meet OBC requirements.

.3 Provide expansion clearance between the damper or damper sleeve and the opening in which the damper is required. Ensure that the openings are properly sized and located, and that all voids between the damper sleeve and the opening are properly sealed to maintain the rating of the fire barrier.

.4 Where the size of the fire barrier opening requires the use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC - S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

.5 Operational Testing: All fusible link dampers shall be tested in accordance with NFPA 80 and NFPA 105 as follows:

.1 An operational test shall be conducted after the building’s HVAC system has been balanced.

.2 The operational test shall be conducted under normal HVAC airflow conditions as well as static flow conditions. The damper shall fully close/seal under both test conditions.

.3 After the installation of a damper is completed, an operational test shall be conducted to verify that:

.1 The dampers shall fully close from the open position.

.2 It shall be verified that the system airflow where the damper is installed is within the design velocity.

.4 All inspections and testing shall be documented, indicating the location of the fire damper, date(s) of inspection, name of inspector, and deficiencies discovered The documentation shall have a space to indicate when and how the deficiencies were corrected rating of the damper listing.

.5 Demonstrate re-setting of all fire dampers to the Owner’s representative after fan start/air handling unit startup and air balancing.

.6 After testing, all fusible links shall be reset into the “closed” positon, holding the damper blades in the in the open position, allowing airflow to pass through.

3.7 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or casings connect to fans, where ducts cross building expansion joints, and wherever else shown or specified in the Contract Documents.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum 24 ga) to each edge of the flexible fabric and to the fan, duct, plenum, etc., in accordance with Figures 7-8 and 7-9 in SMACNA HVAC Duct Construction Standards Metal and Flexible Third Edition.

.3 Ensure that connections to the flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

3.8 INSTALLATION OF DUCT ACCESS DOORS

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils (upstream and downstream), fire dampers,

smoke dampers, duct mounted smoke detectors, control and operating dampers, equipment requiring maintenance, duct mounted instrumentation or control devices.

.2 Install in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure that the doors are properly located for damper maintenance.

.4 When requested, submit a sample of proposed duct access doors for review.

.5 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce the ductwork to suit the access door installed.

3.9 INSTALLATION OF INSTRUMENTS TEST PORTS

.1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Mechanical Requirements.

.2 Section 23 30 00 – HVAC Ducts and Plenums.

.3 Section 23 33 00 – Air Duct Accessories.

1.2 REFERENCES

.1 Air Movement and Control Association (AMCA)

.1 AMCA Publication 511, Product Rating Manual for Air Control Devices.

.2 Air Conditioning, Heating, and Refrigeration Institute (AHRI)

.1 ANSI/AHRI 885, Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

.3 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE 36B-63, Method of Testing for Rating the Acoustic Performance of Air Control and Terminal Devices.

.2 ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA, HVAC Duct Construction Standards - Metal and Flexible.

.5 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Shop Drawings:

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

.2 Submit product literature for all equipment in this Section.

.2 Colour Chart(s): Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.4 Store at temperatures and conditions recommended by the Manufacturer.

2 Products

2.1 GENERAL

.1 Grilles, registers, and diffusers for inlets to exhaust and return air system and as outlet for supply air systems shall be sized shown on the Contract Drawings.

.2 Refer to the Grilles and Diffusers Schedule at the end of the Section for additional details.

.3 Where special colour finish or material is noted submit samples for the Consultant selection. Refer to the Contract Drawings for model and capacity.

.4 Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1800 mm (6 ft.) above the floor shall be 0.127 to 0.254 m/s (25 to 50 fpm).

.5 Noise generated by diffusers shall be such that room sound pressure level does not exceed NC 32 with an 8 db room attenuation, the sound power level reference to 10 to –12 power watts.

.6 Diffusers shall meet test requirements of ASHRAE Standard 36B-63, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63.

.7 In gypsum board or plaster ceiling applications, provide matching mounting frame. Colour to match ceiling.

.8 In T-bar ceilings, manufacturer shall coordinate diffuser compatibility with T-bar ceiling specified by the architectural division. Colour shall match colour of ceiling tile in lay-in ceilings. Diffusers to suit ceiling grid as required imperial or metric.

.9 Acceptable manufacturers are:

.1 E.H. Price Ltd.

.2 Nailor Industries Inc.

.3 Titus HVAC.

.4 Krueger.

.5 Enviro-Tec.

2.2 SQUARE SUPPLY DUFFUSERS

.1 All diffusers shall be steel plaque diffusers constructed of square, coned metal with a powder coat finish.

.2 Diffusers shall consist of a precision formed back cone of one piece seamless construction which shall incorporate a round (or square) inlet collar of sufficient length for connecting rigid or flexible duct as shown.

.3 An inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck.

2.3 RETURN, EXHAUST AND TRANSFER GRILLES

.1 Return, exhaust and transfer registers shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return.

.2 The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated or galvanized steel.

.3 Door transfer grilles unless otherwise specified shall have finely spaced blades for a sight proof appearance and are designed for applications in doors or partitions with Sections as thin as 35 mm (1-3/8") with flat border and countersunk holes.

.4 General appearance, type of material and finish shall match supply grilles within item 2.4.

2.4 EGGCRATE RETURN GRILLE

.1 Return grilles shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick.

.2 Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system.

.3 Colour shall match adjacent ceiling tiles.

3 Execution

3.1 INSTALLATION OF DIFFUSERS, REGISTERS, AND GRILLES

.1 Provide grilles and diffusers where shown on the Drawings. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit. The mechanical drawings show intent and number of diffusers, grilles and registers required.

.2 Wherever possible, diffusers, registers, and grilles shall be the product of one manufacturer. Unless otherwise specified connect diffusers, registers, and grilles in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Provide sheet metal plenums, constructed of the same material as the connecting duct, for linear grilles and/or diffusers where shown on the Contract Drawings. Construct and install the plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip the duct connection collar(s) with volume control device(s).

.4 Install in accordance with manufacturer's instructions. Fit frame with gasket to prevent leakage and smudging. Install with flat head cadmium plated screws in countersunk holes where fastenings are visible.

.5 Install mounting frame tied into plaster and gypsum board ceilings to allow lay in type diffusers to rest on the frame.

.6 Contractor shall caulk around edges of linear diffusers in installations with imperfect walls.

.7 Paint ductwork visible behind air outlets matte black.

.8 Confirm diffuser, register, and grille finishes prior to ordering.

GRILLE AND DIFFUSER SCHEDULE

Tag	Service	Model	Description	Finish	Mounting
S-1	S/A	SPD-24x24	Plaque ceiling diffuser, 24"x24" steel	B12 - white powder coat	Lay-in
S-1a	S/A	SPD-12x12 in 24x24 frame	Plaque ceiling diffuser, 12"x12" steel	B12 - white powder coat	Lay-in
S-2	S/A	620-F-L-A	Louvred face, double deflection grille	Aluminum	Screw-in
R-1	R/A	80	Eggcrate	Aluminum	Screw-in
R-2	R/A	630-F-L-A	Louvred face, single deflection, 45deg.	Mill	Screw-in

*Models selected based on EH Price

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 20 05 00 – General Requirements.

.2 Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC.

.3 Section 23 21 13 – Hydronic Piping.

.4 Section 23 21 16 – Hydronic Piping Specialities.

1.2 REFERENCES

.1 Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

.1 ANSI/AHRI 1410, Performance Rating of Commercial Finned Tube Radiation.

.2 American Society of Testing and Materials (ASTM)

.1 ASTM B75/B75M, Standard Specification for Seamless Copper Tube.

.3 International Organization for Standardization (ISO)

.1 ISO 9001, Quality management systems.

.4 Ontario Building Code 2012 (OBC)

1.3 SUBMITTALS

.1 Product Data: Submit the Manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Provide baseboard performance data showing entering air temperature, leaving air temperature, capacity W/m (BTU/hr per ft), entering water temperature, leaving water temperature, flow rate, and pressure drop.

.2 Submit drawings indicating overall dimensions as well as installation, operation, and service clearances. Indicate operating weights, construction materials, and components.

.3 Closeout Submittals: Provide operation and maintenance data for incorporation into the O&M manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with the Manufacturer's name and address.

.2 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.3 Follow all written instructions and store at temperatures and conditions recommended by the Manufacturer.

1.5 WARRANTY

.1 Provide parts warranty for 1 year from shipment date.

2 Products

2.1 FINNED-TUBE CONVECTORS

.1 Copper-Aluminium Heating Elements:

.1 Heating elements shall be fed with either water or a glycol-water mix, with capacities as indicated in the Baseboard Heater Schedule at the end of this section.

.2 Copper-Aluminium heating elements shall consist of aluminum fins not less than .016 thick with integral fin collars, which space the fins and provide good tube to fin surface contact, permanently bonded to copper seamless drawn tubing by mechanically expanding the copper tubing, to ensure durability and eliminate noise from loose fins, while assuring performance at specified ratings.

.3 The ends of the tube shall be finished OD (male) on one end and finished ID (female swaged) on the other end as to allow the use of standard domestic copper fittings.

.4 Elements will be provided from 300 to 3600 mm (1 to 12 ft) lengths in 150 mm (6") increments complete with the following features:

.1 Copper tube nominal diameters: 13 mm (½”).

.2 Tubes: 3-tubes.

.3 Nominal Depth: 150mm (6”).

.5 Elements be rated for the following working pressures:

.1 13 mm (½”)– 2. 0 MPa (300 psi) at temperatures up to 149ºC (300ºF).

.2 Architectural Enclosures:

.1 Enclosures shall be of the size and style as indicated on the Drawings and the Baseboard Heater Schedule at the end of this section.

.2 Enclosures shall be manufactured from 16-gauge cold rolled steel. All enclosures shall be reinforced with a minimum of two gussets welded at ends of each enclosure style.

.3 The joining of enclosure shall be accomplished by use of internal joggle joiners providing added rigidity and alignment with adjoining enclosures. No sheet metal screws or other fastening devices shall be visible. Enclosures will be provided from 300 to 2400 mm (1 to 8 ft) lengths in 150 mm (6") increments.

.4 The upper portion of the enclosure will be secured in a hinge type manner by use of a full length roll formed mounting channel or full back panel, while the lower portion of the enclosure will be secured to steel snap expansion brackets by use of a positive locking, bottom mounting clip using fasteners thus preventing removal without tools.

.5 Aluminum discharge grilles to be one continuous length. Discharge grille shall have a standard mill finish with a 0-degree deflection and be a “pencil proof” design.

.6 All enclosures and accessories shall be degreased and chemically phosphatized before application of a durable, attractive electrostatic epoxy powder coating. Color to be selected by Architect during construction administration from standard color chart.

.3 Accessories:

.1 Pedestal Brackets: must provide for lengthwise movement of elements during expansion and contraction as well as aligning elements to prevent contact with brackets, walls or enclosure. Brackets to be made of 4.75 mm (3/16") steel with 19 mm (¾") coupling for pedestal mounting. The pedestal mount includes a pipe nipple and floor flange, fasteners to secure the pedestal to the floor by others

.2 Barefin Brackets: All hanger brackets shall be die formed from 16-gauge galvanneal for rigidity. All hangers must provide for lengthwise movement of elements during expansion and contraction as well as aligning elements to prevent contact with brackets, walls, or enclosures

.3 Access doors: shall be provided in the enclosure where maintenance access is required for the serving of flow control or shut off valves. On pedestal models the access doors will have an overall size of 100 mm x 150 mm (4" x 6"). Doors shall be hinged at the top and use a slotted fastener to operate. Recessed security Allen head operators shall be used to prevent unauthorized access to the valves.

.4 Trim: A variety of trim pieces may be used between ends of enclosures and walls on wall-to-wall installations (inside corners, outside corners, wall trims, end caps and removable access panels). Trims may be overlapping or butt-type depending on the application. All trims will be manufactured from 18-gauge cold rolled steel.

.4 Products shall be manufactured in accordance with ISO 9001, and shall meet the AHRI 1410 performance standards.

.5 Acceptable manufacturers are:

.1 Zehnder Rittling

.2 Modine Manufacturing Company

.3 Vulcan Radiator (Mestek, Inc)

.4 Slant/Fin Corporation

.5 Sigma Corporation

3 Execution

3.1 INSTALLATION OF FINNED-TUBE CONVECTORS

.1 Furnish and install finned tube heating elements and architectural enclosures as indicated on the Drawings and Baseboard Heater Schedule in this section.

.2 All required mounting components and accessories shall be included.

.3 All dimensioning shall be based off the Architectural Drawings. Ensure that all enclosures are level and plumb with architectural finishes. Where necessary, angle the finned tube systems to match the wall or slope of a floor.

.4 Connect with piping in accordance with the Drawings and detail. When lacking such information conform to manufacturer's installation instructions and piping detail.

CONVECTOR HEATER SCHEDULE

Tag	**BBH**
Manufacturer	Modine
Model No.	SF064832A0L1NNNNB0IV
Service	Finished Areas, Triple Row
Element Data	
Fluid	Hot Water
No. of Rows	3 (and return)
Tube Dia. (mm)	15ø
Fin Dims. (mm)	-
No. of Fins/ft	-
Capacity, W (BTU/hr)	3126 (10,669)
Max Pressure Drop, Pa (“ w.g.)	498 (2)
EWT, °C (°F)	82.2 (180)
LWT, °C (°F)	71.1 (160)
EAT, °C (°F)	11.1 (20)
Enclosure Data	
Enclosure Type	Slope-Top Floor Mounted
Length, m (ft.)	See notes
Height, mm (in.)	800 (32”)
Width, mm (in.)	1200 (48”)
Installed Height, mm (in.)	800 (32”)
Remarks	1,2
Remarks 1. C/w flow control valve and shut off valves. Wired to associated controllers. 2. Units shall be wall-to-wall (or column), field measure. C/w flow control valve, shut off valves, and wired to thermostat.	

END OF SECTION

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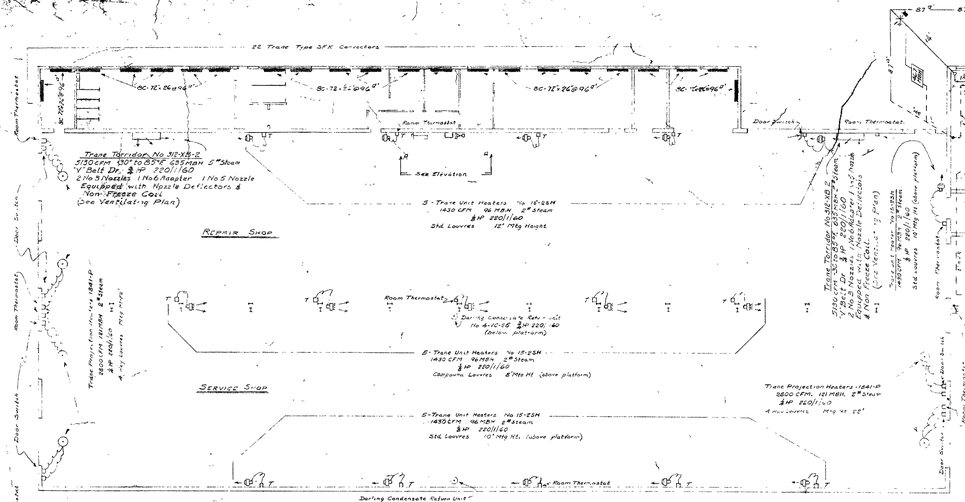
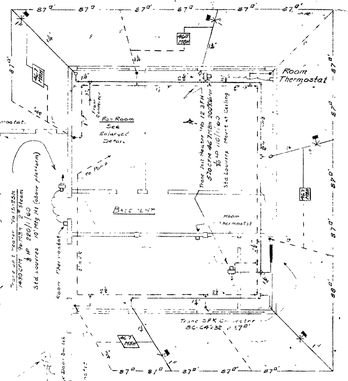
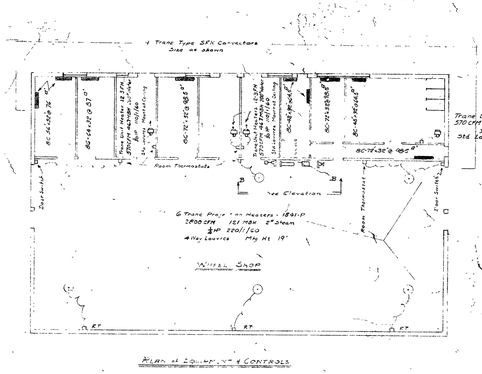
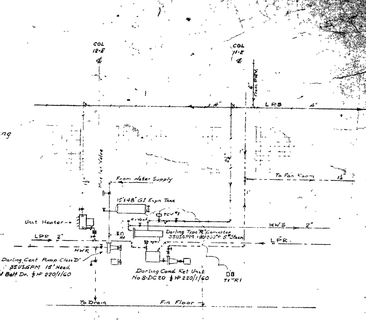
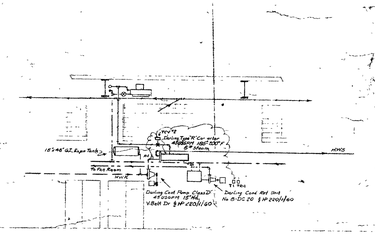
MOTOR + DRIVE
CANVAS CONNECTION
PLAN
SECTION A-A
WHEEL REPAIR SHOP
FAN IN LOCKER ROOM
FAN NO. 1
MASONRY OPENING
FAN NO. 1
MASONRY OPENING
FAN NO. 3
LUBRICATING OIL AND PARTS STORAGE BUILDING
FAN IN FILTER + PARTS CLEANING ROOM
FAN NO. 3
SECTION A-A
DIESEL SERVICE AND REPAIR SHOP
FAN NO. 6
PLAN
ELEVATION
Mount Fan & Motor on 3" Grout Pad, Anchor Bolts To Be Set Into Floor Slab.
Fan No. 8: Trane No. 54-B1-SWS1 Fan, 38160 C.F.M., 2¼" S.P., 584 R.P.M., Arr. 3, Bottom Horizontal Disch.; Var. Speed Drive ±15%; 30 H.P., 1150 R.P.M., 440/3/60.
Inlet Louvre & Screen Manual Control
LUBRICATING OIL & PARTS STORAGE BUILDING
FAN NO. 8: FAN ROOM
SECTION A-A
WHEEL REPAIR SHOP
FAN IN BRAKE ROOM
FAN NO. 2
MASONRY OPENING
FAN NO. 2
LUBRICATING OIL AND PARTS STORAGE BUILDING
FAN NO. 4 LOCKER RM
FAN NO. 5 LUB OIL RM
MASONRY OPENING
FAN NO. 7
DIESEL SERVICE AND REPAIR SHOP
GENERAL OFFICE EXHAUST
FAN NO. 7
ONTARIO NORTHLAND RAILWAY — NORTH BAY
DIESEL SERVICE & REPAIR SHOP &
WHEEL REPAIR SHOP
FAN INSTALLATION DETAILS
Scales: ¼" & ½" = 1 FT.
PROCTOR, REDFERN & LAUGHLIN
CONSULTING ENGINEERS
Drawn By
Checked By

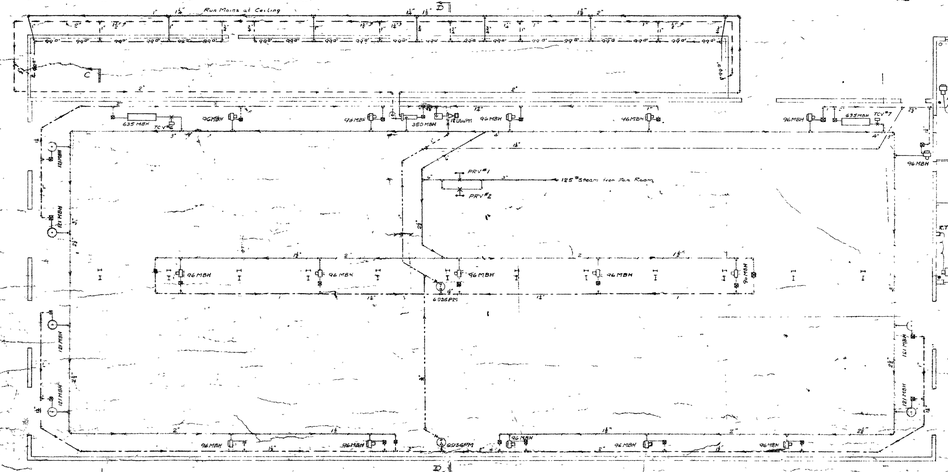


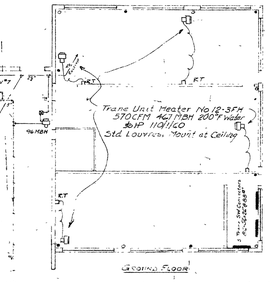


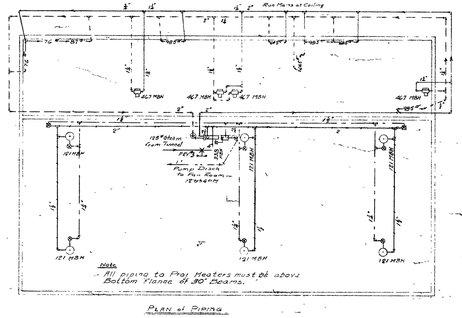


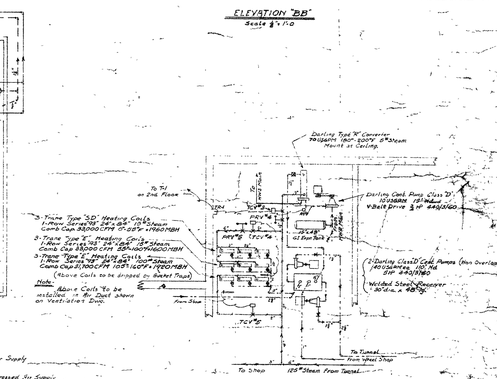


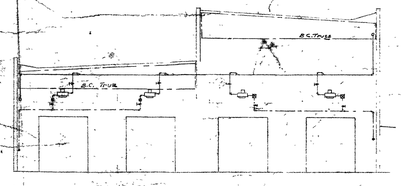


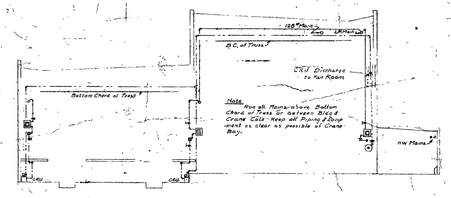


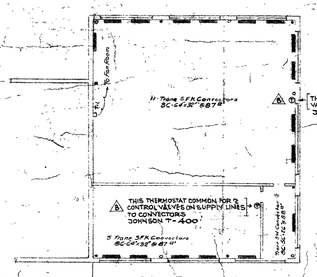


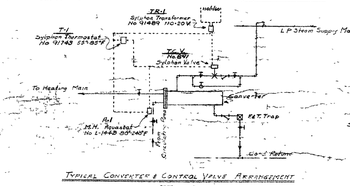


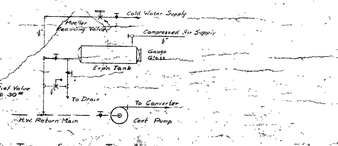


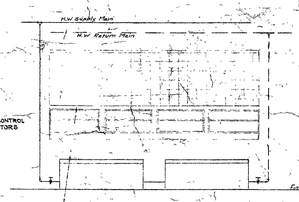


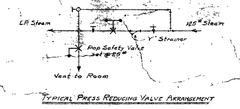












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PLAN of EQUIPMENT & CONTROLS

NOTE
(B) THE 5 CONTROL VALVES MARKED THUS ⊼ SHALL BE 1" "JOHNSON" "SYLPHON" V-150.

PLAN of EQUIPMENT & CONTROLS

ELEVATION "AA"
Scale ⅛"=1'-0"

ELEVATION "BB"
Scale ⅛"=1'-0"

PLAN of PIPING

GROUND FLOOR

PLAN of PIPING

PLAN of FAN ROOM
Scale ¼"=1'-0"

TYPICAL CONVERTER & CONTROL VALVE ARRANGEMENT

TYPICAL EXPANSION TANK ARRANGEMENT

(B) THIS THERMOSTAT COMMON FOR 3 CONTROL VALVES ON SUPPLY LINES TO CONVECTORS JOHNSON T-400

SECTION "CC"

SECTION "DD"

SECOND FLOOR

CONVECTOR ARRANGEMENT for O'HEAD MAINS

TYPICAL PRESS REDUCING VALVE ARRANGEMENT

LEGEND

- Hot Water Supply Main.
- Hot Water Return Main.
- 125 p.s.i. Steam.
- Low Press. Steam.
- Low Press. Condensate Return.
- Condensate Return Pump Discharge.
- ⊠ Float & Thermostatic Trap.
- ⊗ Bucket Trap.
- Press. Reducing Valve.
- Temperature Control Valve.
- Gate Valve.
- Globe Valve.
- 'Y' Strainer.
- Check Valve.
- Safety Relief Valve.
- □ R.T. T-42A M.H. Thermostat.

TEMPERATURE CONTROL VALVE SCHEDULE

VALVE No	SIZE	TYPE	TEMP RANGE	PRESS	STEAM FLOW	REMARKS
TCV#1	2½"	Sylphon #891	See Thermostat	5#	350#/hr	
TCV#2	2½"	do	do	5#	450#/hr	
TCV#3	3"	do	do	5#	700#/hr	
TCV#4	1½"	Sylphon #923 QT	60°-120°F	125#	3560#/hr	Finned Bulb-Duct Type
TCV#5	1"	do	90°-150°F	125#	1920#/hr	do do
TCV#6 & 7	2"	Sylphon #928-C	75°-90°F	5#	635#/hr	Sep. Bulb & Adjustment

Locate Bulb in Center Discharge Nozzle of Torridor & Adjustment Knob on Wall below.

PRESSURE REDUCING VALVE SCHEDULE

VALVE No	SIZE	TYPE	PRESSURES #/sq in. INITIAL	FINAL	SET AT	STEAM FLOW	REMARKS
PRV#1	1 x 2	Darling Series 41	125	0-10	6	1200#/hr	
PRV#2	1½ x 3	do do	125	0-10	4	2800#/hr	
PRV#3	¾"	do Series 40	125	0-10	5	650#/hr	
PRV#4	¾"	do do	125	0-10	5	700#/hr	Single Seated
PRV#5	2½"	do do	125	3-25	15	3600#/hr	

TRAP SCHEDULE

HEATING UNIT	LOCATION	TRANE MODEL No	SIZE	QTY REQD	TYPE
L.P. Blast Coils	Fan Room	350-25	1"	6	Bucket
H.P. Blast Coils	Fan Room	350-150	1"	3	Bucket
Proj Heaters	Wheel Shop	60-25	¾"	4	Bucket
Unit & Proj Heaters		A-L.P.	¾"		F&T
End of Main		A-L.P.	¾"		F&T
Converter - 35 GPM	Repair Shop	C-L.P.	1¼"	1	F&T
Converter 45 GPM	Wheel Shop	C-L.P.	1¼"	1	F&T
Converter 70 GPM	Fan Room	H-L.P.	1½"	1	F&T
Torridors	Repair Shop	C-L.P.	1½"	2	F&T

Note - 'Y' Strainers to be installed ahead of all Traps.

REV	DATE	PARTICULARS	BY
(B)	MAR.1/54	2ND FLOOR CONVECTOR CONTROL SYSTEM REVISED	[illegible]
A	23/4/51	Unit Heaters put on individual Thermostats	

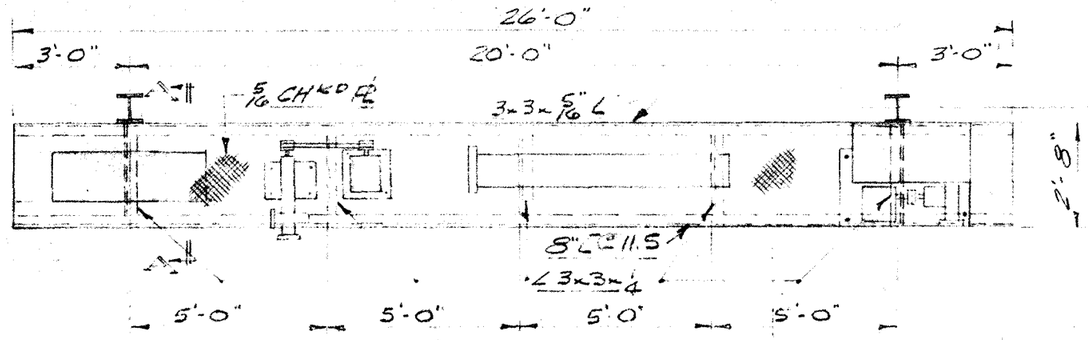
ONTARIO NORTHLAND RAILWAY - NORTH BAY

HEATING
DIESEL SERVICE & REPAIR SHOPS
LUB OIL & PARTS STORAGE BLDG
WHEEL REPAIR SHOP

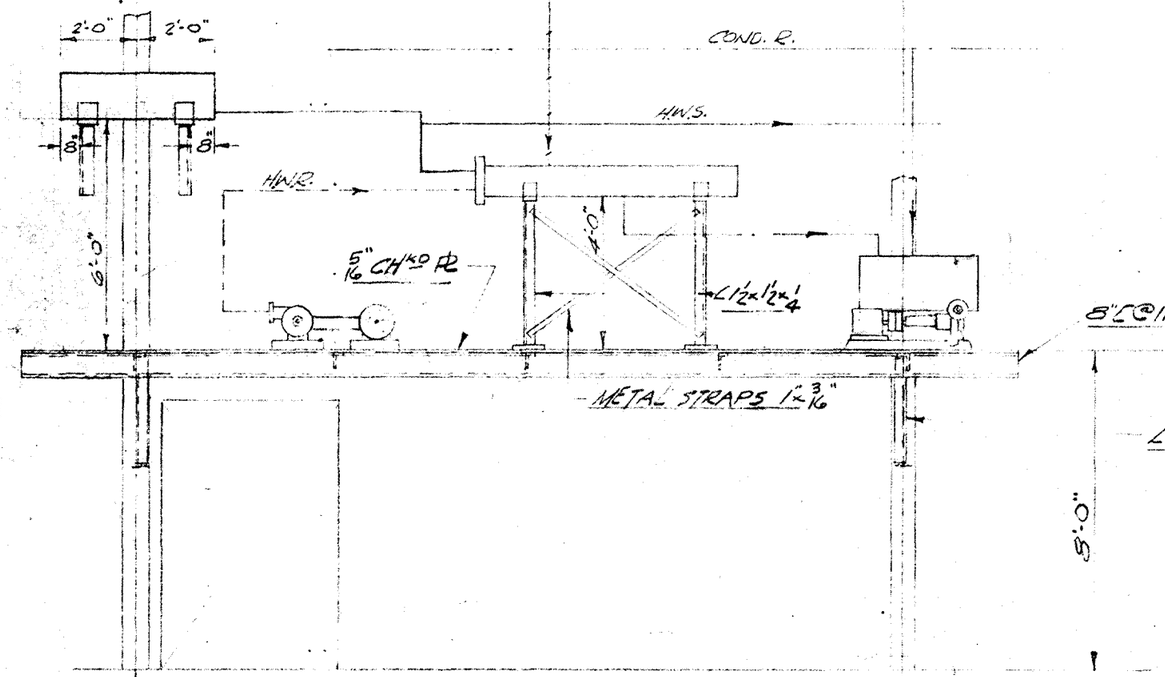
Scale 1/16"=1'-0" Date [illegible]

PROCTOR [illegible]

1A-109x — 189x



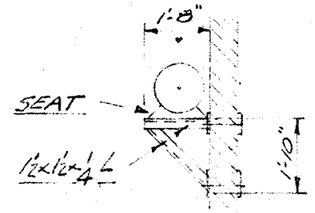
PLAN



ELEVATION

scale: 1/4"-1'-0"

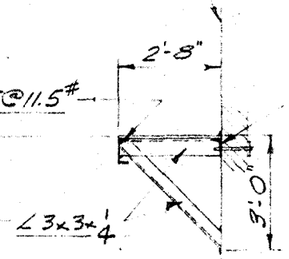
(4) (5)



SECTION A-A

BRACKET WELDED & TO BE BOLTED TO WALL

FACE OF COL.



3x3x5/16" L - FASTEN TO BRICK WALL WITH ½" ANCHORS & HEAD SHIELDS @ 2'-6" CTRS.

NOTE:- JOIN ALL STEEL MEMBERS BY WELDING & WELD BRACKETS TO COLS. TACK WELD 5/16" CH'KD PL.

ONTARIO NORTHLAND RAILWAY
WHEEL SHOP - NORTH BAY.

BRACKET FOR HEATING EQUIPMENT

SCALE: 1" = 1'-0" | DATE: Feb. 11, 1952

PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS TORONTO

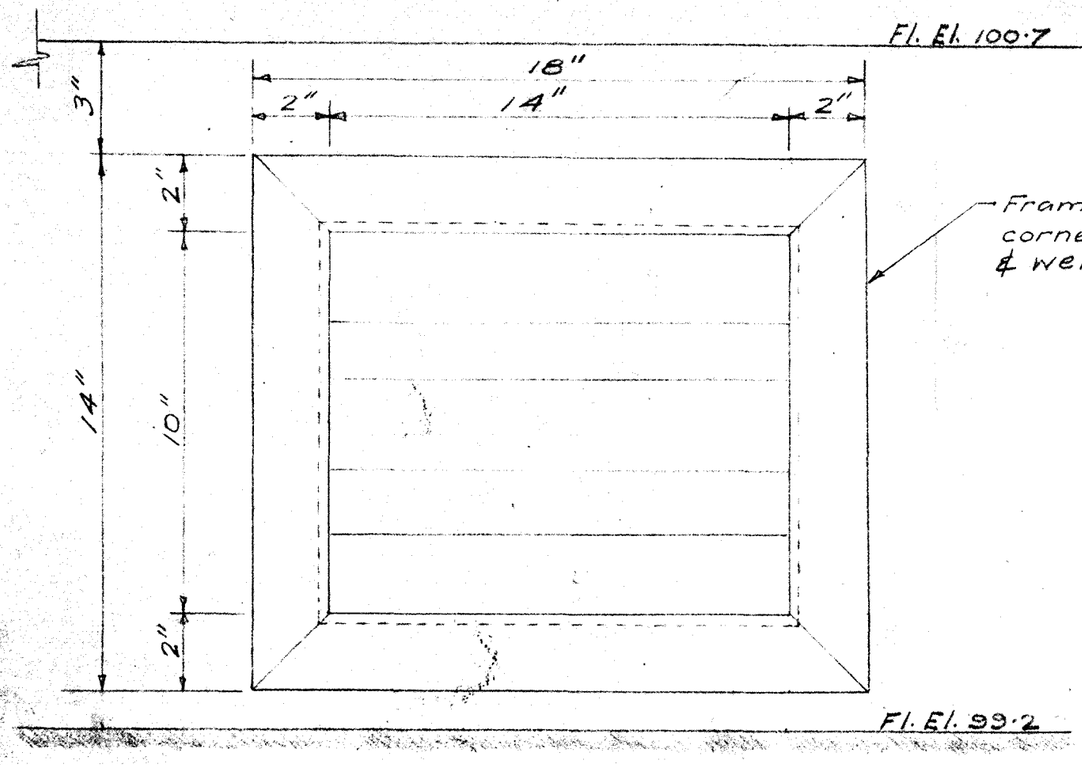
DRAWN BY: T.G.L. | DWG. NO. 1A-189x

CHECKED BY: J.F.W.

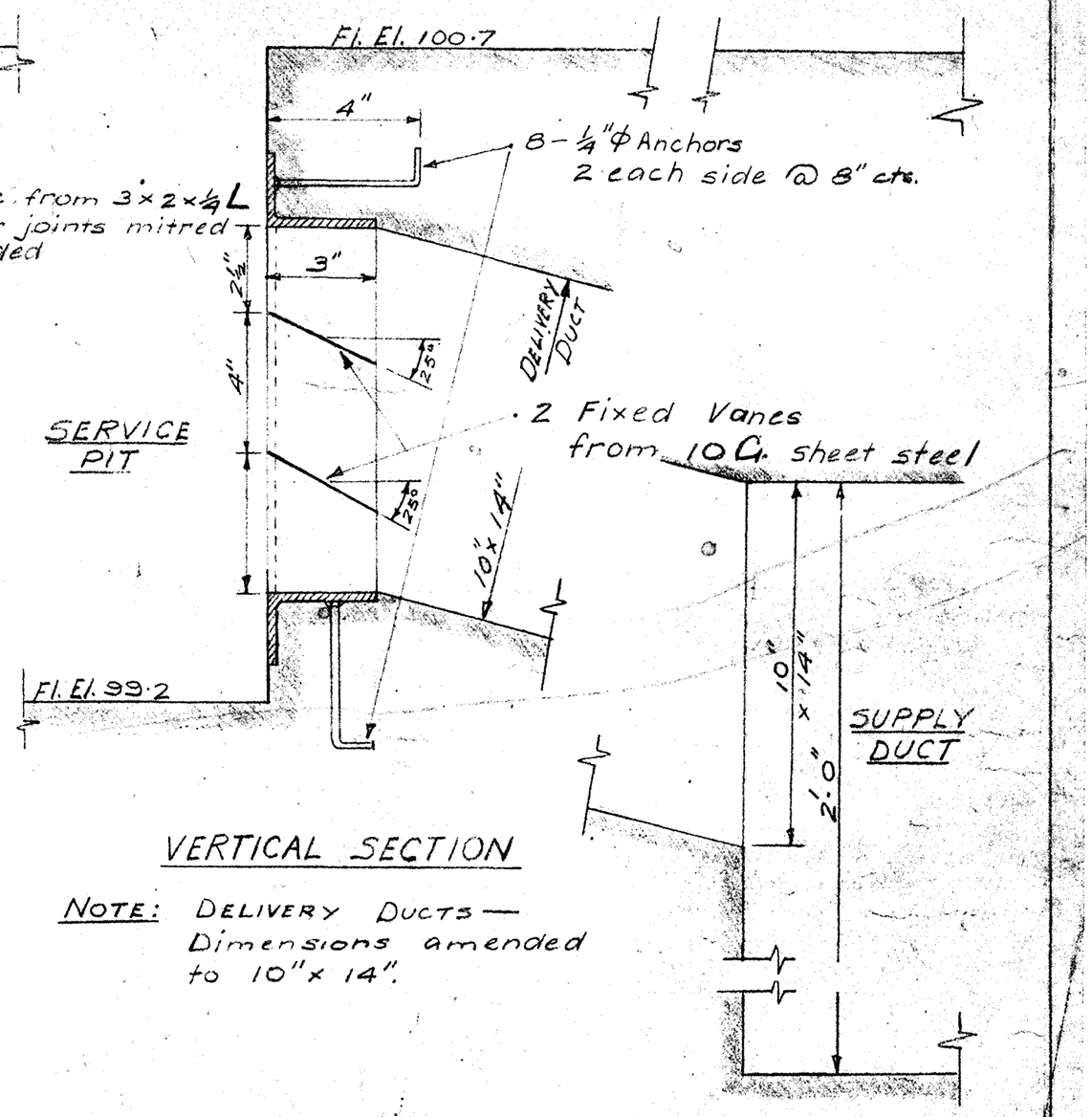
IA-1?? - 190

Service & Repair Shops Plan at Air Ducts
Lub. Oil & Parts Storage Bldg. Bsmt. Fl. Plan
Section "AA"
Section "BB"
Longitudinal Section over Rails — Service Shop
Typical Cross Section
Section through Ventilating Fan
Section "YY"
Sect. "VV"
Sect. "TT"
Detail of Transition Piece between Duct & Floor Frame
Lub. Oil & Parts Storage Bldg. Ground Floor Plan
Lub. Oil & Parts Storage Bldg. 2nd Floor Plan
Sect. CC (Typical)
Elevation of Exhaust Hood & Duct
Sect. "ZZ"
Sect. "XX"
Service & Repair Shops Roof Plan
Schematic Diagram of Control Circuit for Roof Ventilators over Service Shop
Schematic Diagram of Control Circuit for Roof Ventilators over Diesel & Wheel Repair Shops
3 | 23/11/51 | Revised Duct Layouts, & to Fan #3
2 | 11/7/51 | Depth of Exhaust Hood reduced 3"
A | 21/4/51 | Control Circuits added
Rev. | Date | Particulars
ONTARIO NORTHLAND RAILWAY — NORTH BAY
DIESEL SERVICE AND REPAIR SHOP
LUBRICATING OIL AND PARTS STORAGE BLDG.
WHEEL REPAIR SHOP
VENTILATION
PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS — TORONTO
Scale - As noted
Drawn By - P.H.M.

1A-190 X1 -190 X1



FRONT ELEVATION

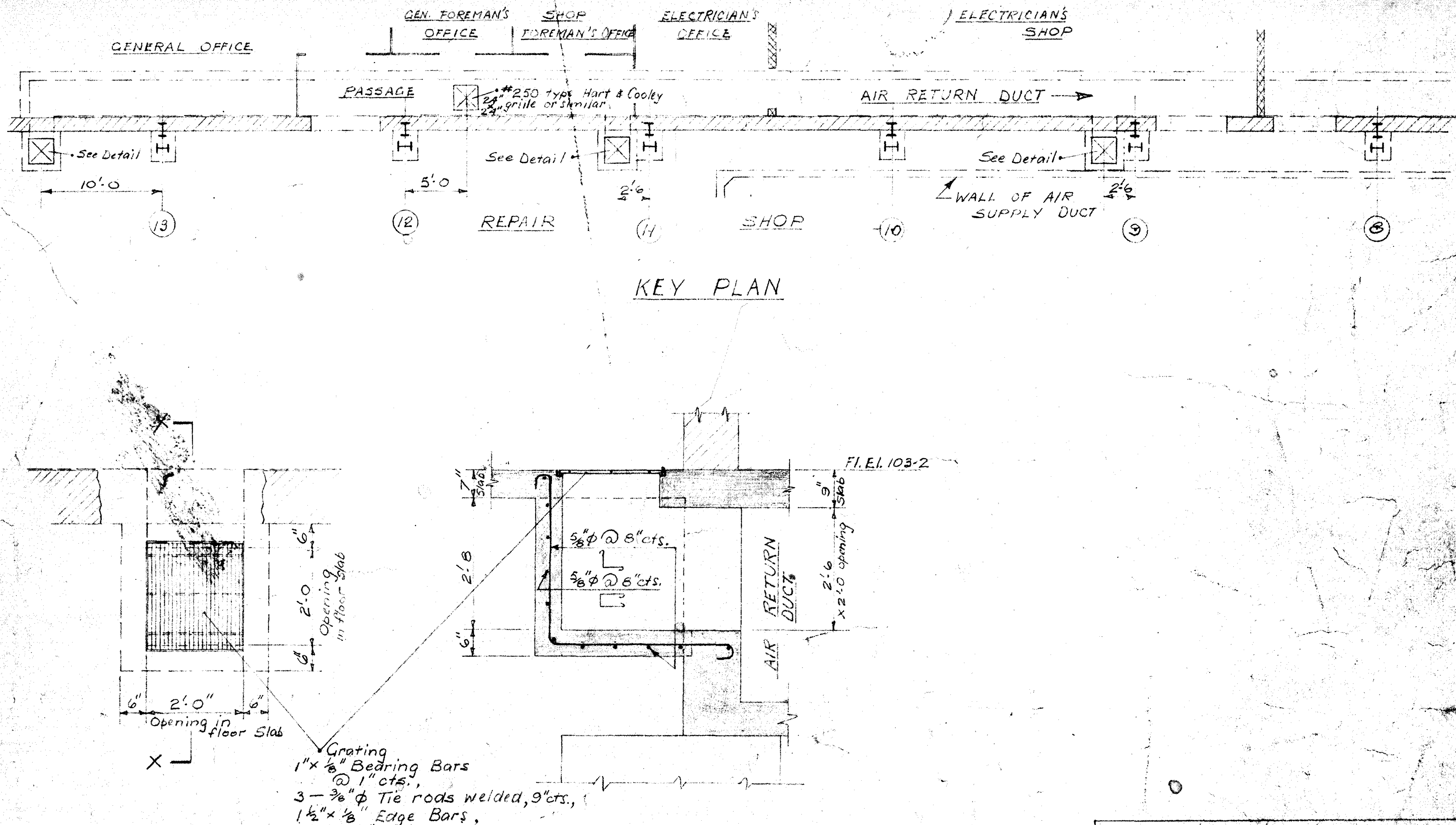


VERTICAL SECTION

NOTE: DELIVERY DUCTS — Dimensions amended to 10"×14".

ONTARIO NORTHLAND RAILWAY DIESEL SERVICE & REPAIR SHOP – NORTH BAY	
AIR DELIVERY DUCTS OPENING FRAMES SERVICE PITS	
SCALE: 3 IN. = 1 FT.	DATE: JAN. 24/52
PROCTOR, REDFERN & LAUGHLIN CONSULTING ENGINEERS TORONTO	
DRAWN BY T.A.V.	DWG. NO. 1A-190X1
CHECKED BY I.F.W.	

1A-190X2 190 X2



TYPICAL DETAIL

AIR RETURN DUCTS & GRATINGS
(in Repair Shop)

ONTARIO NORTHLAND RAILWAY NORTH BAY	
DIESEL SERVICE & REPAIR SHOP DETAILS AIR RETURN DUCTS & GRILLES	
SCALES: 1/8" & 1/2" = 1 Ft.	DATE: June 1952
PROCTOR REDFERN & LAUGHLIN CONSULTING ENGINEERS TORONTO	
DRAWN BY: T.A.J. CHKD. BY: J.W.	JOB NO.	DWG. NO. 1A-190X2

IA-191 - 191

Repair Shop
Service Shop
Filler Hose Post
Filler Hose Posts
1¼" Oil Supply Line
Passenger Locomotive 54'-8
Lub Oil & Parts Storage Bldg (Basement)
1½ Oil Drain Lines
Use Plugged Tees instead of Couplings between Standard 20 ft. Pipe lengths
Plan of Lub. Lubricating Oil Supply & Drain System
General Section through Service Shop
Plan of Service Supply Systems (Air, Steam & Distilled Water)
Note
Distilled Water Lines not in this Contract.
Repair Shop
Service Shop
Valve Stand-16-Reqd.
Lub Oil & Parts Storage Bldg (Basement)
Filter & Parts Cleaning Room
Lub Oil & Parts Storage Bldg. (1st Fl.)
Wheel Repair Shop
Detail of Valve Stand
16-Reqd.
Section A-A
10000 Gallon Oil Storage Tank
Note: All Tank Plating to be 5/16" Thickness.
Saddles to be of 3/8" ₵ Welded.
Steel Saddle
32'-0" (Inside Heads)
36'-10¾" (Wall to Wall)
Section B-B
Drained Oil Tank
Note: Tank Plating 3/16" Thickness
2" Drained Oil Pipe
Rectangular Base Framed From 6 ⌊s 8.2, Joined at Corners with Welded Mitre Joints
2x2x¼ ∟ Stiffeners Welded in All Vert. & Horiz. Corners
2" Cock
Note: Distilled Water Lines Not in this Contract
3 Additional Oil Supply Lines & Filler Hose Posts Dec.5/51 T.A.J.
2 Details of Drained Oil Tank Dec.5/51 T.A.J.
1 Details of Oil Storage Tank Dec.5/51 T.A.J.
No. Revisions Date By
Ontario Northland Railway - North Bay.
Compressed Air & Lubricating Oil Systems
Diesel Service & Repair Shops
Lub Oil & Parts Storage Bldg
Wheel Repair Shop
Scale - As noted
Proctor Redfern & Laughlin
Consulting Engineers
Drawn By PHM
Chkd By
Apvd By
Dwg No.

IA-192 IA- 192

REVISIONS			
Nº	DESCRIPTION	DATE	BY
△	General revisions to meet field conditions	Dec. 1953	S. Felsz.

ONTARIO NORTHLAND RAILWAY—NORTH BAY

DIESEL SERVICE AND REPAIR SHOP
LUBRICATING OIL AND PARTS STORAGE BLDG
WHEEL REPAIR SHOP

ROOF SANITARY & FLOOR DRAINS

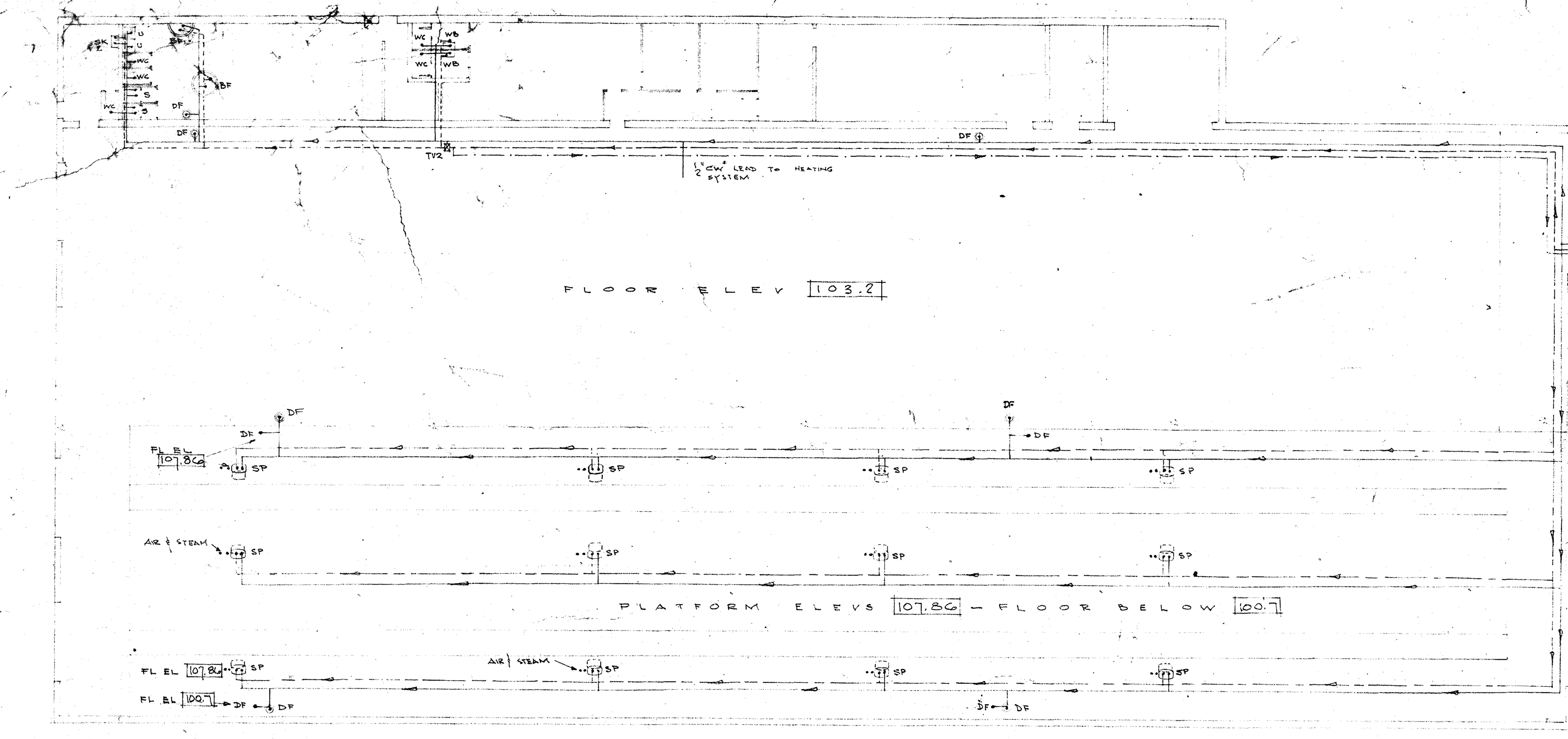
SCALE: 1/16" = 1'-0" & 1/4" = 1'-0" DATE: FEB 51

PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS TORONTO

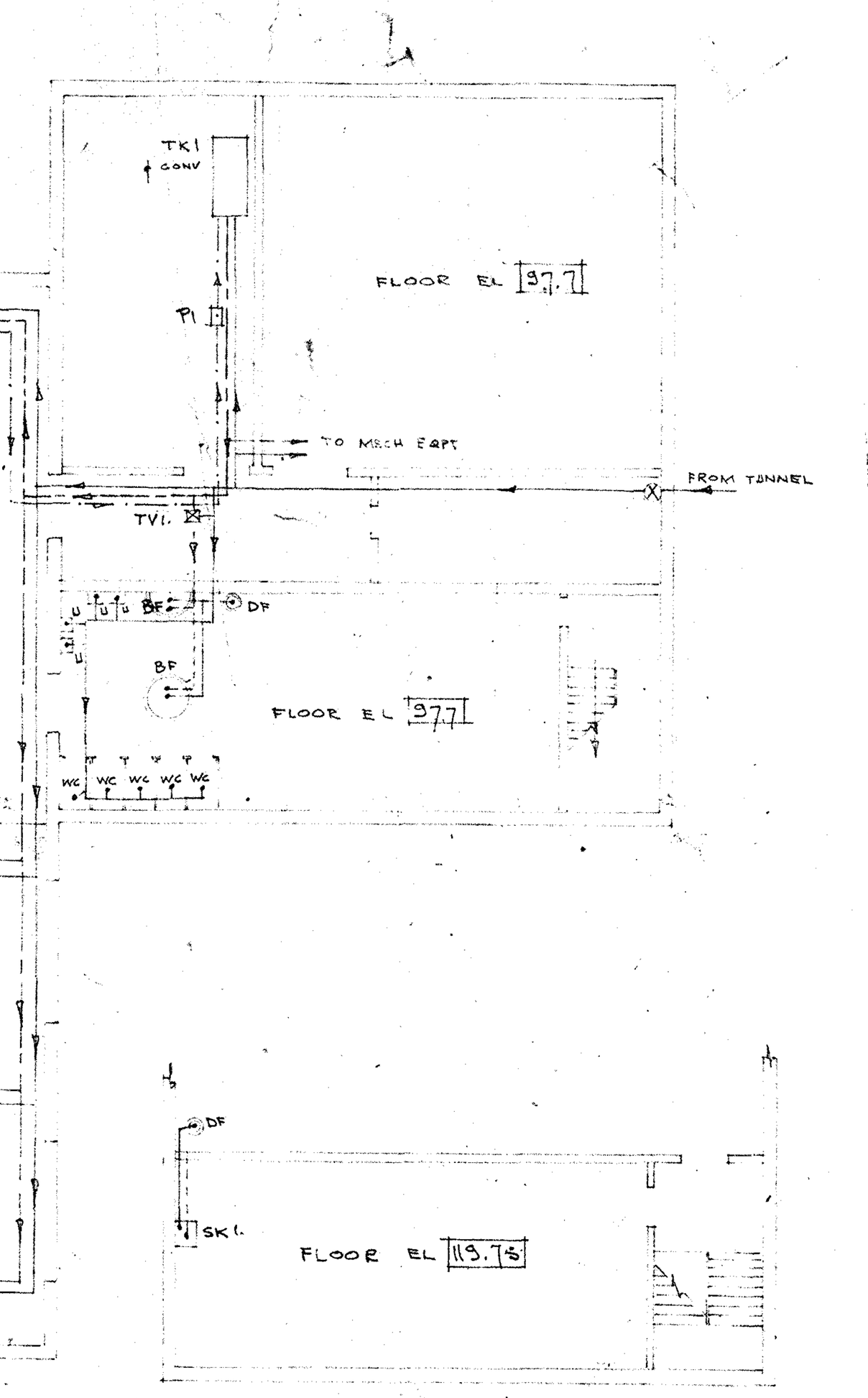
DRAWN: J.F. Wyllie & P.R. Hertzberg
CHECKED: J.F.W.
APP'D

DWG Nº IA-192

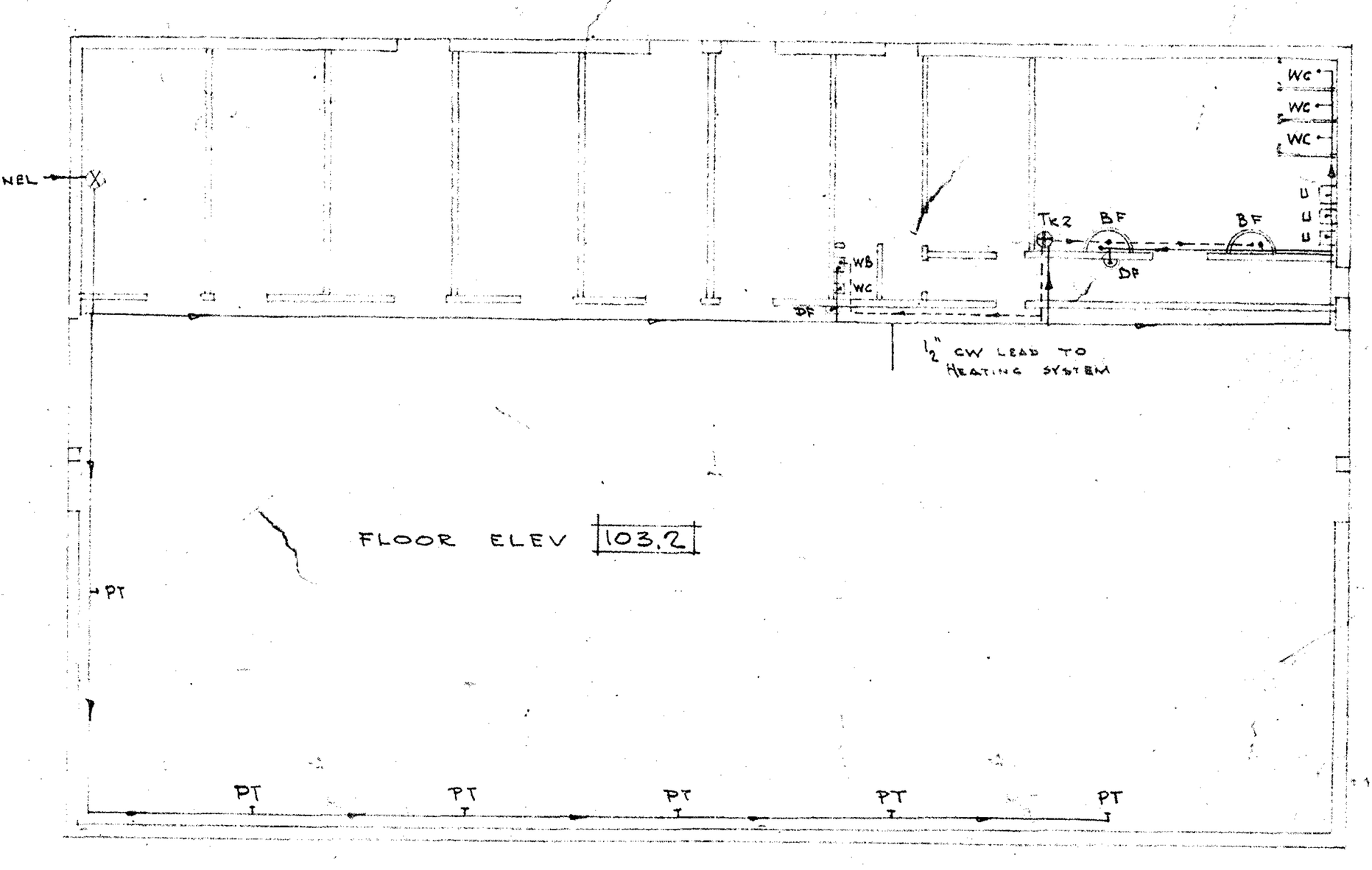
IA-193



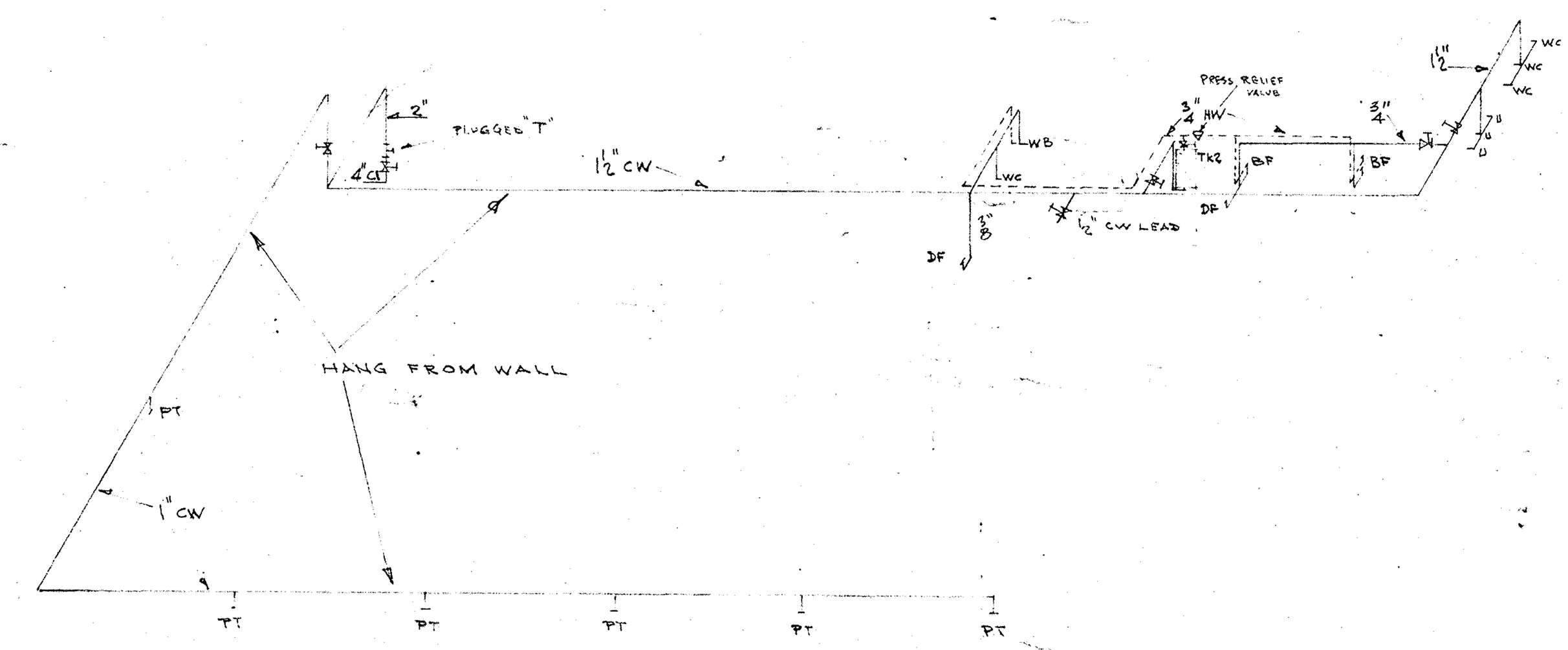
—PLAN DIESEL REPAIR SHOP—



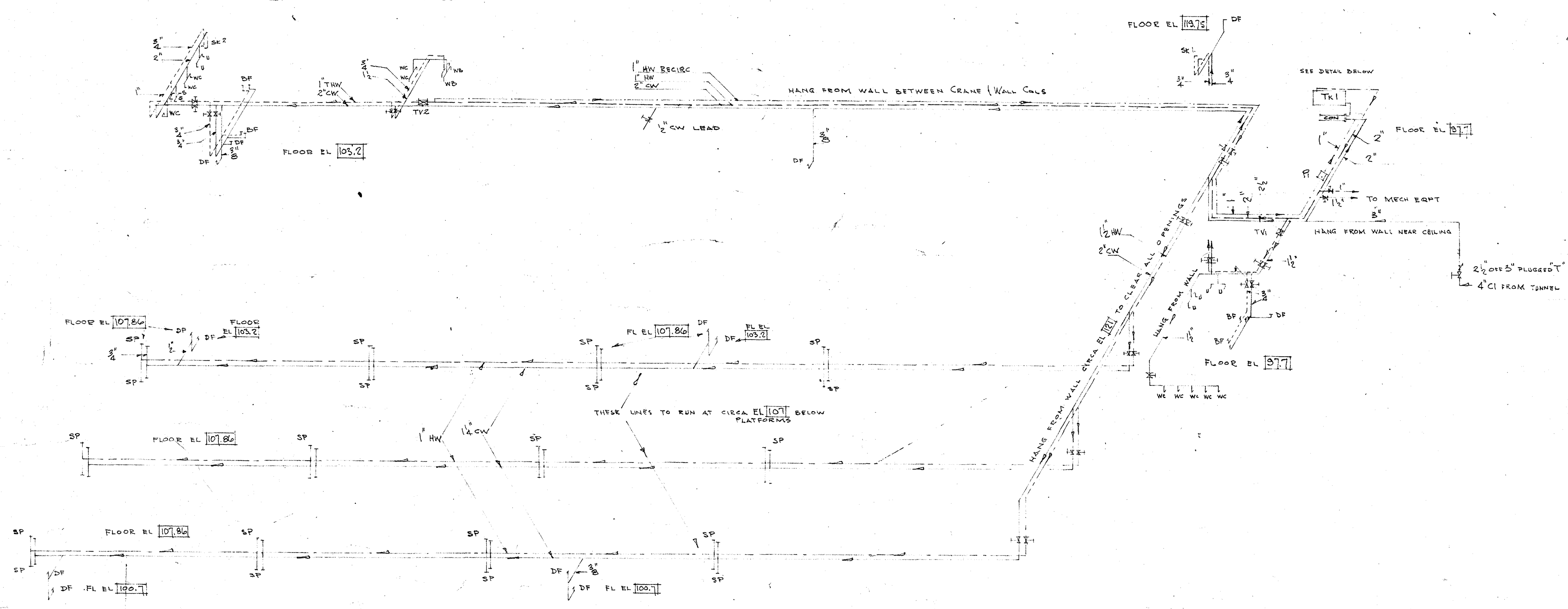
—PLAN SECOND FLOOR—



—PLAN OF WHEEL SHOP—

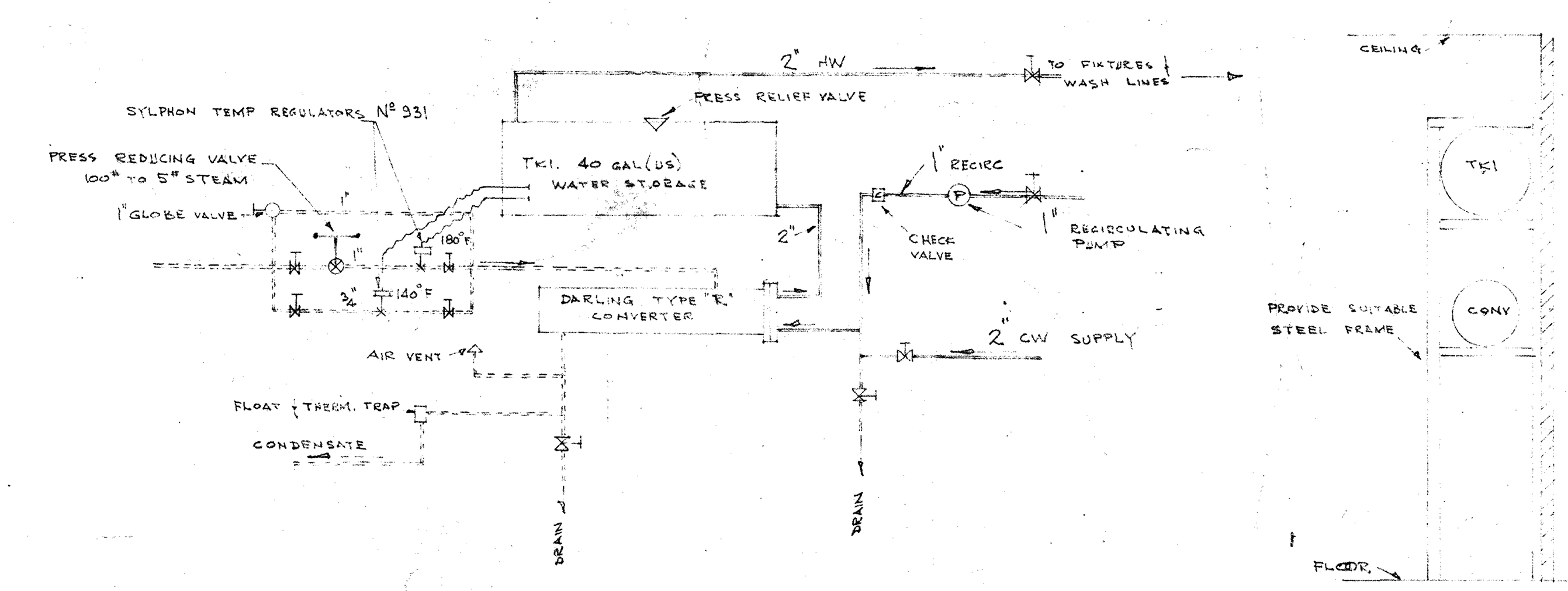


—RISER DIAGRAM WHEEL SHOP—



—RISER DIAGRAM DIESEL REPAIR SHOP—

NOTE: WASH WATER SUPPLY (SP) LINES LEAD TO A COMMON VALVE STAND WITH AIR & STEAM LINES. AIR & STEAM LINES AND DETAIL OF STAND ARE SHOWN ON DRWG IA.191.



SIDE ELEVATION

END ELEVATION

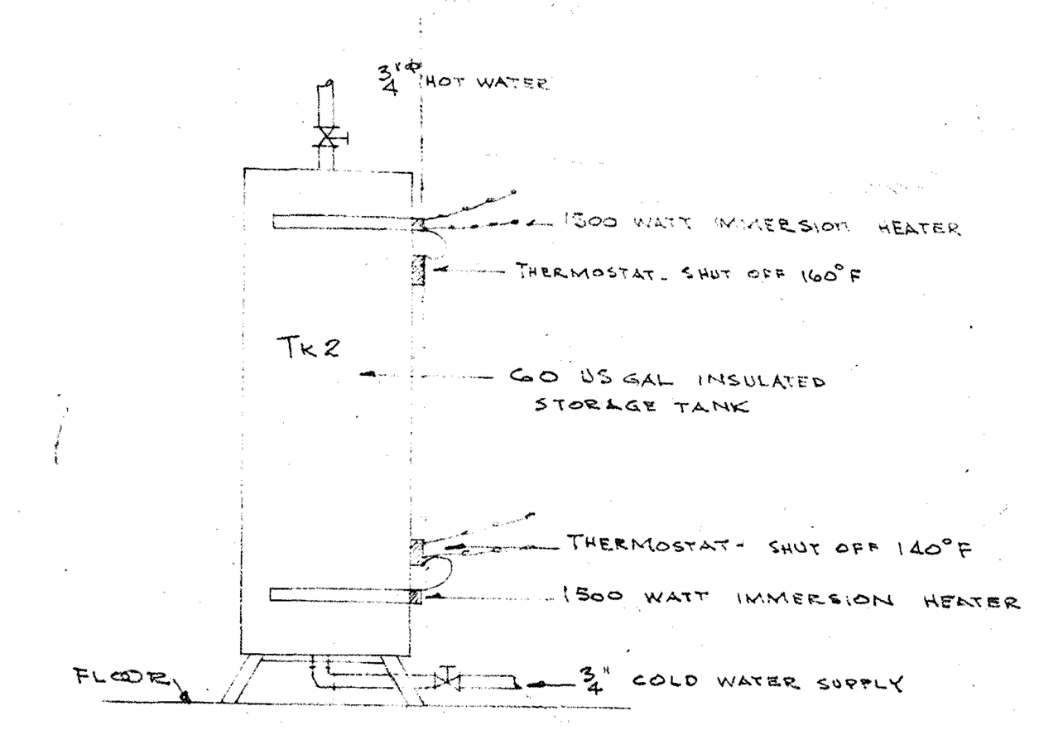
—DETAIL OF TANK AND CONVERTER UNIT—

NOTE: (1) CONVERTER CAPACITIES: (a) 3.5 USGPM 40°F-180°F 5# STEAM - ASSISTED CIRCULATION
(b) 20 " 40°F-140°F 100# " - FORCED "

(2) INSTALLATION OF WATER STORAGE TANK, CONVERTER AND HOT AND COLD WATER LINES TO SAME INCLUDING RECIRC PUMP, CHECK VALVE ETC BY PLUMBING CONTRACTOR

(3) STEAM CONNECTIONS INCL TEMP REGULATORS ETC BY HEATING CONTRACTOR

(4) TEMPERATURE REGULATORS
(a) 1" #931. SHUT OFF TEMP 180°F. RANGE 140°-180°F. STEAM 5#
(b) 3/4" #931. " " 140°F " 120°-160°F " 100#



DETAIL FOR TANK #2

SCHEDULE OF FIXTURES

	FIXTURE	QUANTITY	TYPE	CONNECTION COLD	CONNECTION HOT	REMARKS
WHEEL SHOP:						
1.	W.C.	4	#3401	1"		
2.	W.B.	1	#1766	3/8"	3/8"	22" x 19"
3.	U.	3	#8050	3/8"		BATTERY OF 3 WITH TANK NO. 7561
4.	DF.	2	#2041	3/8"		
5.	BF.	2	CFA 54"	3/4"	3/4"	BRADLEY WASH FOUNTAIN OF "MARMOGRAN" PRECAST MARBLE - PROVIDE ADAPTORS FOR PAPER TOWELS & POWDERED SOAP DISPENSERS
DIESEL REPAIR SHOP						
1.	WC	9	#3401	1"		
2.	WB	2	#1766	3/8"	3/8"	22" x 19"
3.	U	6	#8050	3/8"		BATTERIES OF 2 WITH TANK #7561
4.	DF	13	F.223	3/8"		30" HIGH
5.	BF	2	CFA 54"	3/4"	3/4"	BRAD. WASH FTNS OF "MARMOGRAN" PRE-CAST MARBLE - PROVIDE ADAPTORS FOR PAPER TOWELS AND POWDERED SOAP DISPENSERS
6.	BF	2	AFA 54"	3/4"	3/4"	
7.	SK 1	1	F 286	1/2"	1/2"	CUPBOARDS BELOW - SEE SPECS
8	SK 2	1	F 288 (L)	1/2"	1/2"	CUPBOARDS BELOW - SEE SPECS
9.	SP	12	SEE DETAIL			SEE DRWG IA-191 FOR STAND DETAIL

LEGEND

SYMBOL	DESCRIPTION	REMARKS
CW	COLD WATER	
HW	HOT WATER	
THW	TEMPERED HOT WATER	
R	HOT WATER RECIRCULATION	
	GATE VALVE	
W.C.	WATER CLOSET	
U.	URINAL	
WB	WASH BASIN	
BF	BRADLEY WASH FOUNTAIN	54"Φ FULL & 54"Φ HALF UNITS
SK	SINK	
DF	DRINKING FOUNTAIN	
S	SHOWER	
PT	PLUGGED "T"	
TK	WATER STORAGE TANK	
TV	TEMPERING VALVE	
SP	WASH WATER SUPPLY POINT	HOT & COLD LINES TO BE BROUGHT INTO SINGLE HOSE BIBB WITH HOT & COLD CONTROLS SEE DRWG No IA-191 FOR STAND DETAIL

ONTARIO NORTHLAND RAILWAY—NORTH BAY.

DIESEL SERVICE AND REPAIR SHOP
LUBRICATING OIL AND PARTS STORAGE BLDG
WHEEL REPAIR SHOP

PLUMBING

SCALE: 1/16" = 1'-0" DATE: MAR. 51

PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS TORONTO

DRAWN: P.A.H.
CHECKED: J.F.W.
APP'RD

DWG NO IA-193

1A-194 1A- 194


DIESEL SERVICE & REPAIR SHOP — UPPER LEVEL
LUBRICATING OIL & PARTS STORAGE — 1ST FLOOR
LUBRICATING OIL & PARTS STORAGE — 2ND FLOOR
FLOOR PLAN — WHEEL REPAIR SHOP
TRANSFORMER "A"
TRANSFORMER "B"
TRANSFORMER "C"
TRANSFORMER "D"
1000 WATT INCANDESCENT FIXTURE TYPE "A" ALTERNATING WITH TWIN 400 WATT MERCURY VAPOUR UNITS FIXTURE TYPE "B" CONTROL CIRCUITS ONLY TO PANEL "B"
750 WATT INCANDESCENT FIXTURE TYPE "D" ALTERNATING WITH 400 WATT MERCURY VAPOUR FIXTURE TYPE "E"
STANDARD SPACING
FIXTURES TYPE "K"
PANEL K2
PANELS E & F
TRANSFORMERS E & F
PUMP 3 H.P. MOTOR OUTLET 30A 440/3/60
220V/1Ø/60 MOTOR OUTLET - 30A FOR VENT'N FAN - 3/4 HP

A	April 20 '51	REVISED FOR MOTOR OUTLETS	EM
REV.	DATE	PARTICULARS	BY

ONTARIO NORTHLAND RAILWAY — NORTH BAY

DIESEL SERVICE AND REPAIR SHOP
LUBRICATING OIL AND PARTS STORAGE
WHEEL REPAIR SHOP
LIGHTING & ELECTRICAL LAYOUT

SCALE: 1/8" IN. = 1 FT. DATE: MAR. 1951

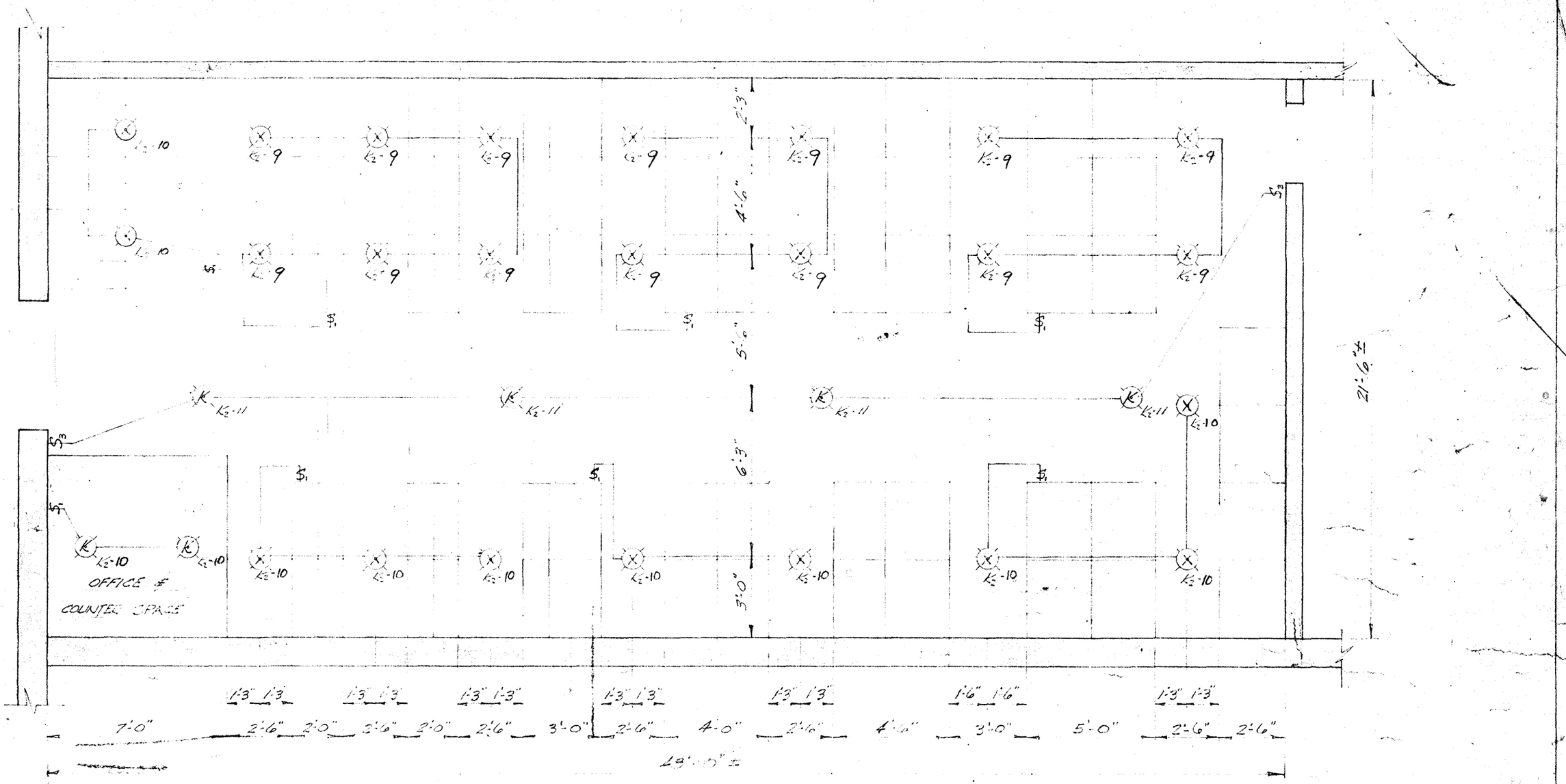
PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS TORONTO

REGISTERED PROFESSIONAL ENGINEER W. H. BONUS PROVINCE OF ONTARIO

DRAWN ABCkapman
Checked
Approved - J.T.W.

DWG. No 1A-194

1A-194-X 1A 194-X



REVISED LIGHTING PLAN - DIESEL PARTS STORES - LUBRICATING & PARTS STORAGE BUILDING - NORTH BAY - ONTARIO.
SCALE: 1/4" = 1'-0"

(X) - 24-100W. BENJAMIN "STOCK-BIN-LIGHT" REFLECTORS. MOUNT LEVEL WITH HIGHEST BIN OR SHELF
(K) - 6-150W. HOLOPHANE H-2076-S. MOUNTING HEIGHT 9½ FEET.
NOTE: 18 "K" FIXTURES TO BE EXCHANGED.

ONTARIO NORTHLAND RAILWAY.
— NORTH BAY —

REVISED LIGHTING
DEISEL PARTS STORES

SCALE: 1/4" = 1'-0" | DATE: JULY 23, 1952.

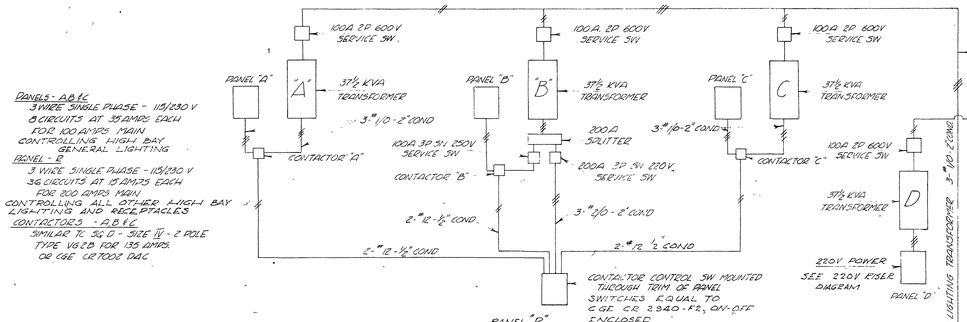
PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS TORONTO.

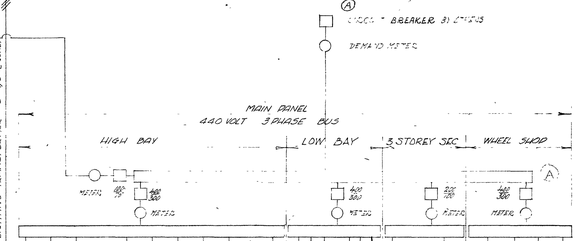
DRAWN BY: T.G. LOW
CHECKED BY: J.H.W.

DWG NO. 1A-194-X.

IA-195 IA- 195

SECTION THROUGH SERVICE TRACK PITS
DIESEL SERVICE & REPAIR SHOP - LOWER LEVEL
LUBRICATING OIL & PARTS STORAGE BLDG.-BASEMENT
MAIN DISTRIBUTION BOARD & METER PANELS
TRANSFORMER
BATTERY CHARGING OUTLET
WELDING OUTLET
LIGHTING (FLUORESCENT) 2 - 40 WATT LAMPS
LIGHTING (INCAND & MERCURY AS INDICATED IN SCHEDULE
DUPLEX RECEPTACLE
COMB DUPLEX RECEPTACLE
WELDING OUTLET
BATTERY CHARGING OUTLET
MOTOR OUTLET AS INDICATED
SWITCH
PIT LIGHTING "F"
NIGHT LIGHTS "T"
W 3 WIRE DUPLEX RECEPTACLE WEATHER PROOF GROUNDED
PANEL
TRANSFORMER
TELEFONE OUTLET BOX WITH COVER (FLUSH)
TELEFONE EMPTY CONDUIT
REVISED FOR MOTOR OUTLETS
REV. DATE PARTICULARS BY
ONTARIO NORTHLAND RAILWAY — NORTH BAY
DIESEL SERVICE & REPAIR SHOP & LUBRICATING OIL & PARTS STORAGE BLDG.
LIGHTING & ELECTRICAL LAYOUT
Scale: 1/8" = 1 FT
Date: Feb. 1951
PROCTOR, REDFERN & LAUGHLIN
Drawn: E. Melbourne
DWG. NO. IA-195
REGISTERED PROFESSIONAL ENGINEER
W. H. BONUS
PROVINCE OF ONTARIO





1A-19[illegible] 1A- 196

PANELS - A,B & C
3 WIRE SINGLE PHASE - 115/230 V
8 CIRCUITS AT 35 AMPS EACH
FOR 100 AMPS MAIN
CONTROLLING HIGH BAY GENERAL LIGHTING

PANEL - R
3 WIRE SINGLE PHASE - 115/230 V
36 CIRCUITS AT 15 AMPS EACH
FOR 200 AMPS MAIN
CONTROLLING ALL OTHER HIGH BAY LIGHTING AND RECEPTACLES

CONTACTORS - A,B & C
SIMILAR TO SQ D - SIZE IV - 2 POLE
TYPE VG2B FOR 135 AMPS.
OR CGE CR7002 DAC

PANELS - E,F,G, & H
3 WIRE SINGLE PHASE - 115/230V.
14 CIRCUITS AT 15 AMPS EACH
FOR 100 AMPS MAIN

PANELS - L,M,N & P
3 WIRE SINGLE PHASE - 115/230V.
36 CIRCUITS AT 15 AMPS EACH
FOR 200 AMPS MAIN
PANELS CONTROLLING - UNDER PLATFORM, PIT LIGHTING, RECEPTACLES AND OUTSIDE LIGHTS IN LOW BAY.

CONTACTORS - E,F,G, & H
SIMILAR TO SQ.D - SIZE III - 2 POLE
TYPE UG2B FOR 90 AMPS.
OR CGE CR7002 D4C.

SUMMARY OF BRANCH CIRCUITS -
6 200 AMPS.
2 - 400 AMPS
6 - 100 AMPS
2 - 60 AMPS
5 - 30 AMPS

PROVIDE SPACE FOR THE FOLLOWING SPARES -
12 - 200 AMPS -
2 - 100 AMPS -
2 - 60 AMPS.
4 - 30 AMPS

WHEEL SHOP POWER CENTRE

BRANCH CIRCUITS FROM PANEL, EXCEPT WELDING OUTLETS, TO BE INSTALLED BY OTHERS

3 WIRE SINGLE PHASE - 115/230V
40 CIRCUITS AT 15 AMPS EACH FOR 200 AMP MAIN

220V SINGLE PHASE - 60~ 60 A HEATING AND VENTILATING MOTOR BRANCH CIRCUIT

PANELS - K1 & K2
3 WIRE SINGLE PHASE - 115/230V
24 CIRCUITS AT 15 AMPS EACH
FOR 100 AMPS MAIN

PANEL - K3
3 WIRE SINGLE PHASE - 115/230V
12 CIRCUITS AT 15 AMPS EACH
FOR 100 AMP MAIN

SCHEDULE OF FIXTURES

LOCATION OF ROOM OR USE OF AREA	MOUNTING HEIGHT FLOOR TO BOTTOM OF FIXTURE	NUMBER OF UNITS	WATTAGE PER UNIT	DESCRIPTION OF UNIT	FIXTURE TYPE SYMBOL	REMARKS
HIGH BAY AREA	38'	30	1000 I	MILLER PRAMK 1000 WITH COVERGLASS	"A"	
		30	TWIN 400MV	MILLER PRAS 2-400 " "	"B"	
LOW BAY AREA	20' TO TRACK	52	750 I	WHEELER #4206 DURATACH	"D"	
		52	400 MV	MILLER PXEDD 400 (DETACHABLE UNIT)	"E"	
PIT LIGHTING		176	150	BENJAMIN #5715	"F"	
UNDER PLATFORM		220	100	WILSON FLUOR 460 WITH GLASS COVER	"G"	
FILTER AND PARTS CLEANING 1ST FLOOR 2 ROOMS	9½'	39	200	WHEELER #4032 EXPLOSION PROOF	"H"	
FOREMAN'S OFFICE	9½'	4	100	CGE. FLUOR INDUSTRIAL #4773 IS	"J"	CHAIN HANGERS
SERVICE SHOP STORES 1ST FLOOR		24	150	HOLOPHANE H-2076-S	"K"	
LECTURE ROOM AND LUNCH ROOM	9½'	90	100	C.G.E. FLUOR TROFFER DAWN 24019 WITH LOUVRE	"L"	
FIRST AID ROOM	9½'	3	150	HOLOPHANE VAPORPROOF #02333	"N"	
WASHROOM AND LOCKER ROOM	9½'	14	150	" " "	"N"	
GENERAL OFFICE	9½'	12	100	CGE FLUOR TROFFER DAWN #24019 WITH LOUVRE	"L"	
LAVATORY	9½'	2	150	CGE KEYSTONE 816680	"P"	
F'MAN OFFICE	9½'	3	100	C G E FLUOR TROFFER DAWN #24019 WITH LOUVRE	"L"	
" OFFICE	9½'	3	100	" " " " " " " "	"L"	
HALLWAY	9½'	3	100	" " " " " "	"L"	
F'MAN OFFICE	9½'	4.	100	" " " " " "	"L"	
ELECTRICIAN SHOP	9½'	18	100	CGE FLUOR INDUSTRIAL #4773 IS	"J"	CHAIN HANGERS
BATTERY ROOM	9½'	4	200	WHEELER #4032 EXPLOSION PROOF	"H"	
ARMATURE BAKING	9½'	6	200	HOLOPHANE VAPORPROOF #02338	"N"	
FAN ROOM	9½'	4	200	WHEELER VAPORTIGHT INDUSTRIAL #2102	"Q"	WITH REFLECTOR
OIL STORAGE	9½'	12	300	WHEELER #4032 EXPLOSION PROOF	"H"	
SWITCHBOARD ROOM	9½'	6	300	WHEELER VAPORTIGHT INDUSTRIAL #2102	"Q"	WITH REFLECTOR
LOCKER ROOM	9½'	16	150	HOLOPHANE VAPORPROOF #02328	"N"	
NIGHT LIGHTS	8'	6		BRACKET WITH MED BASE SOCKET ON CONDULET	"T"	
STAIR LIGHTING	AT CEILING	5	200	CGE #816690 KEYSTONE	"S"	
OUTSIDE LIGHTING	BRACKET 8'	11	150	WHEELER VAPORPROOF #2121 ON BRACKET #226	"R"	
" " (OVER LARGE DOORS)		9	300	" " #2103 " " "	"C"	
UNDER PLATFORM	AT CEILING	22	100	CROUSE-HINDE VAPORPROOF GS 675	"U"	
WHEEL REPAIR SHOP						
WHEEL SHOP	BOTT FIX=BOTT BM	96	100	CGE FLUOR INDUSTRIAL #4773 IS	"J"	WITH CHAIN HANGARS
WASHROOM AND LOCKERS	9½'	12	200	C.G.E KEYSTONE #816690	"S"	
GENERAL OFFICE	9½'	4	100	C.G.E FLUOR TROFFER DAWN #24019 WITH LOUVRE	"L"	
PRIVATE OFFICE	9½'	3	100	" " " "	"L"	
PAINT ROOM	9½'	6	150	WHEELER #4032 EXPLOSION PROOF	"H"	
HOSE ROOM	9½'	3	300	WHEELER #1218	"M"	
DOPE ROOM	9½'	6	150	WHEELER #4032 EXPLOSION PROOF	"H"	
BATTERY ROOM	9½'	6	150	" " " "	"H"	
JACKS LOADING	9½'	3	300	WHEELER #1218	"M"	
BRAKE ROOM	9½'	3	300	" "	"M"	
LAVATORY	9½'	1	150	CGE KEYSTONE #816680	"P"	
HALLWAY	9½'	4	150	" " "	"P"	
NIGHT LIGHTING	8'	4	150	BRACKET WITH MED BASE SOCKET ON CONDULET	"T"	
OUTSIDE LIGHTING	8'	7	150	WHEELER VAPORPROOF #2121 ON BRACKET NO. 226	"R"	
" " (OVER LARGE DOORS)		2	300	" " #2103 " " "	"C"	

NOTE - ALL FLUORESCENT FIXTURES TO HAVE 2×40 WATT TUBES WITH (IS) INSTANT START BALLASTS.

220V SINGLE PHASE 60 CYCLE RISER DIAGRAM FOR HEATING AND VENTILATION EQUIPMENT

REV.	DATE	PARTICULARS	BY
Ⓐ	April, 20,51	REVISED FOR MOTOR OUTLETS & METERING	[illegible]

ONTARIO NORTHLAND RAILWAY - NORTH BAY

DIESEL SERVICE AND REPAIR SHOP
LUBRICATING OIL AND PARTS STORAGE
WHEEL REPAIR SHOP
POWER DISTRIBUTION & FIXTURE SCHEDULE

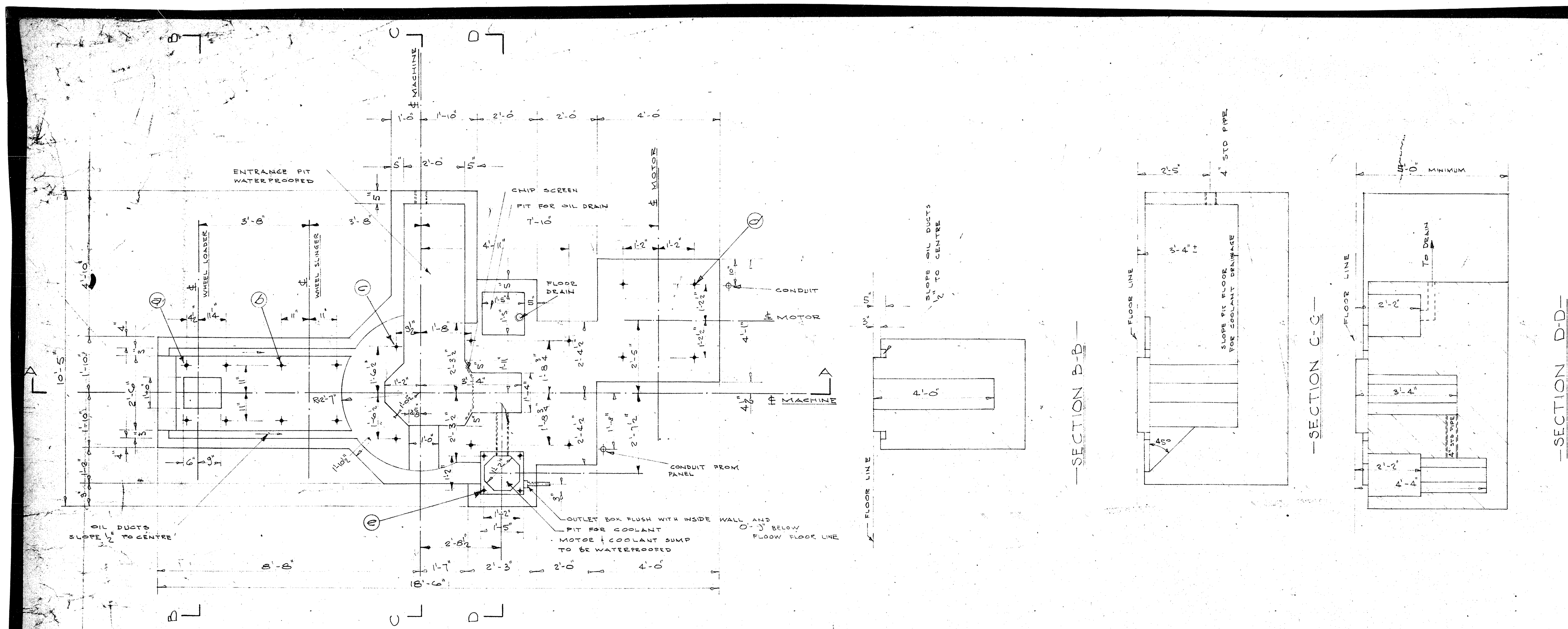
SCALE: NO SCALE DATE [illegible]

PROCTOR, REDFERN & LAUGHLIN
CONSULTING ENGINEERS

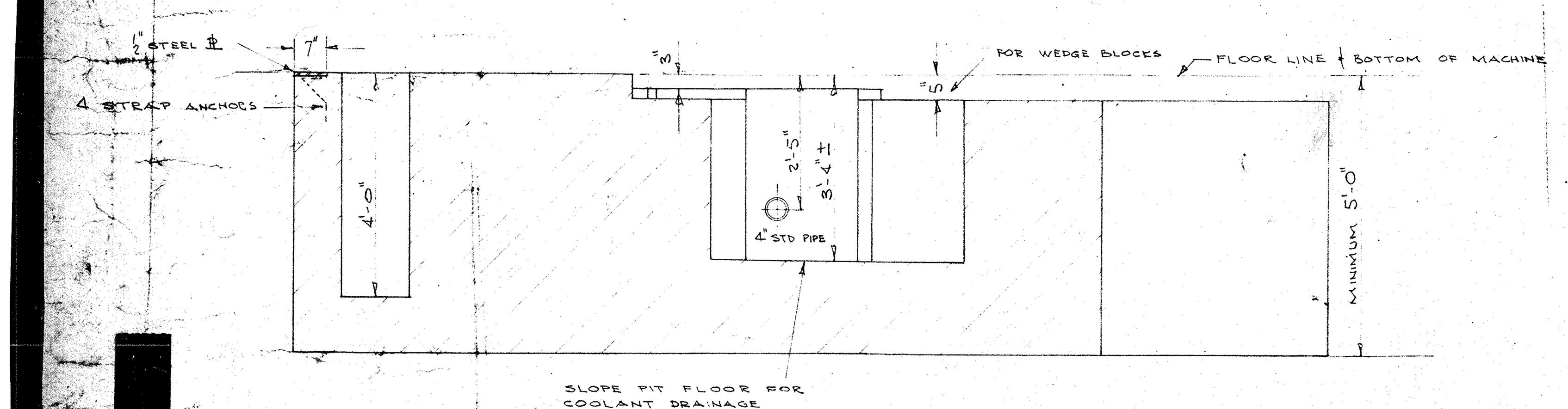
DRAWN A.B.C.
CHECKED
APPROVED

W. H. BONUS

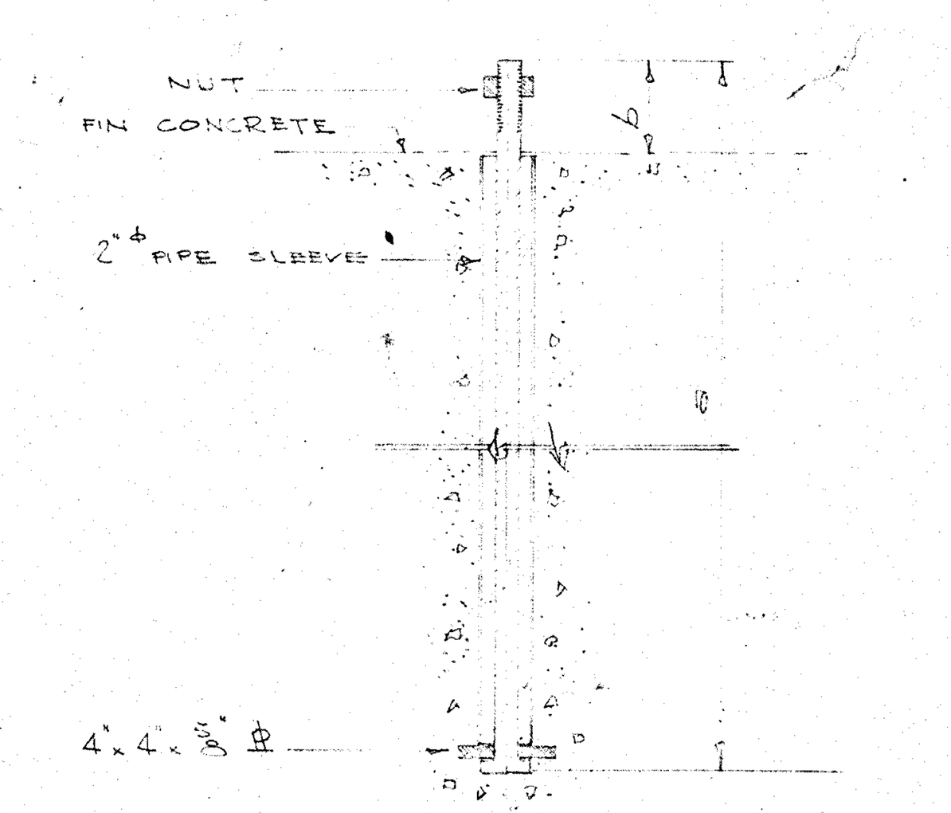
IA-1̄7 IA- 197



—PLAN— SECTION B-B SECTION C-C SECTION D-D



—SECTION A-A—



—SECTION THRO' ANCHOR BOLT—

SCALE 1½"=1'-0"

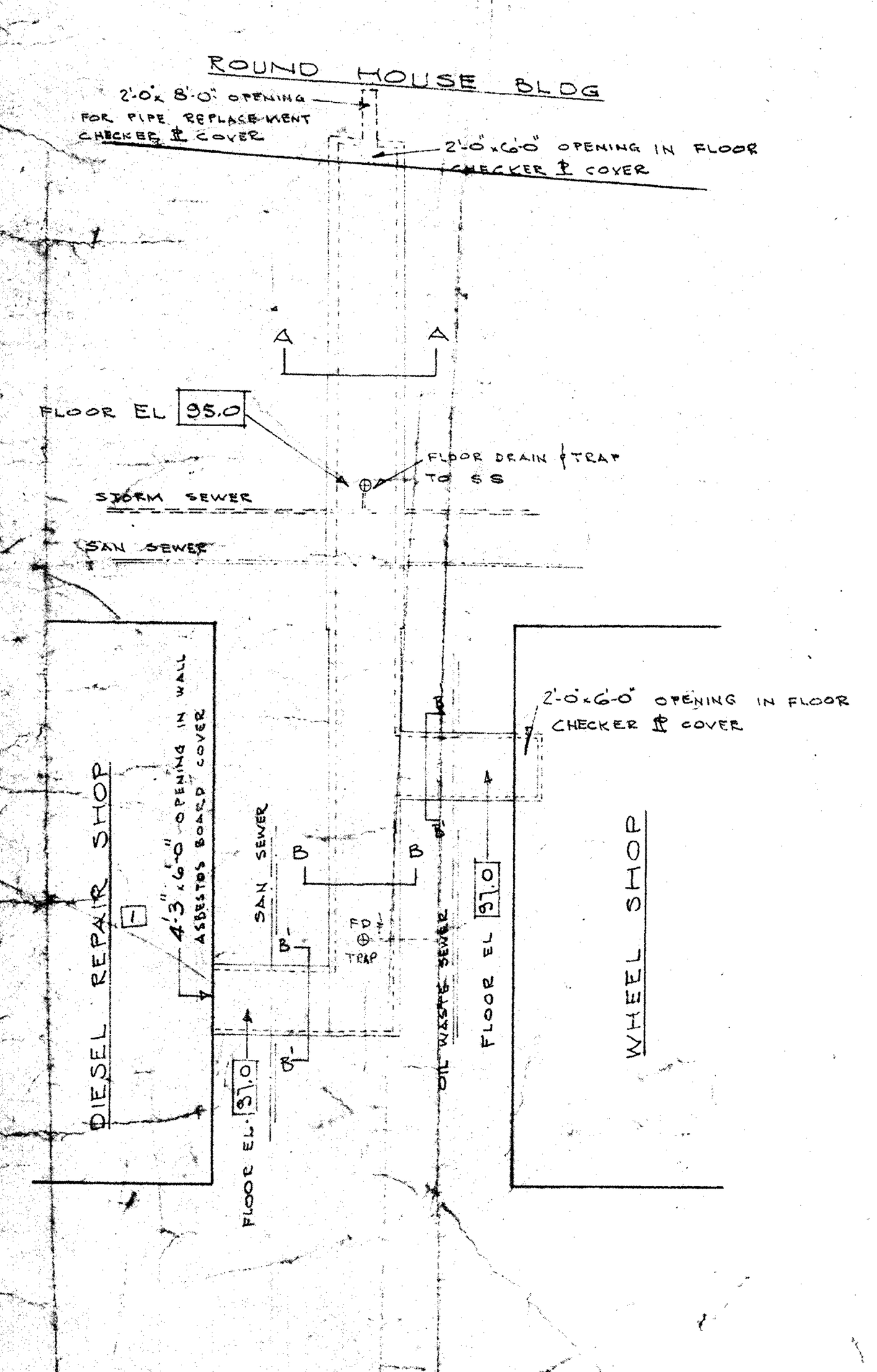
—SCHEDULE of BOLTS—

GROUP	Nº	DESCRIPTION diam.	"a"	"b"
a	4	⅝"	2'-6"	3½"
b	4	⅝"	2'-6"	2½"
c	6	⅞"	3'-4"	10"
d	4	⅞"	2'-6"	3"
e	4	⅝"	2'-6"	4"

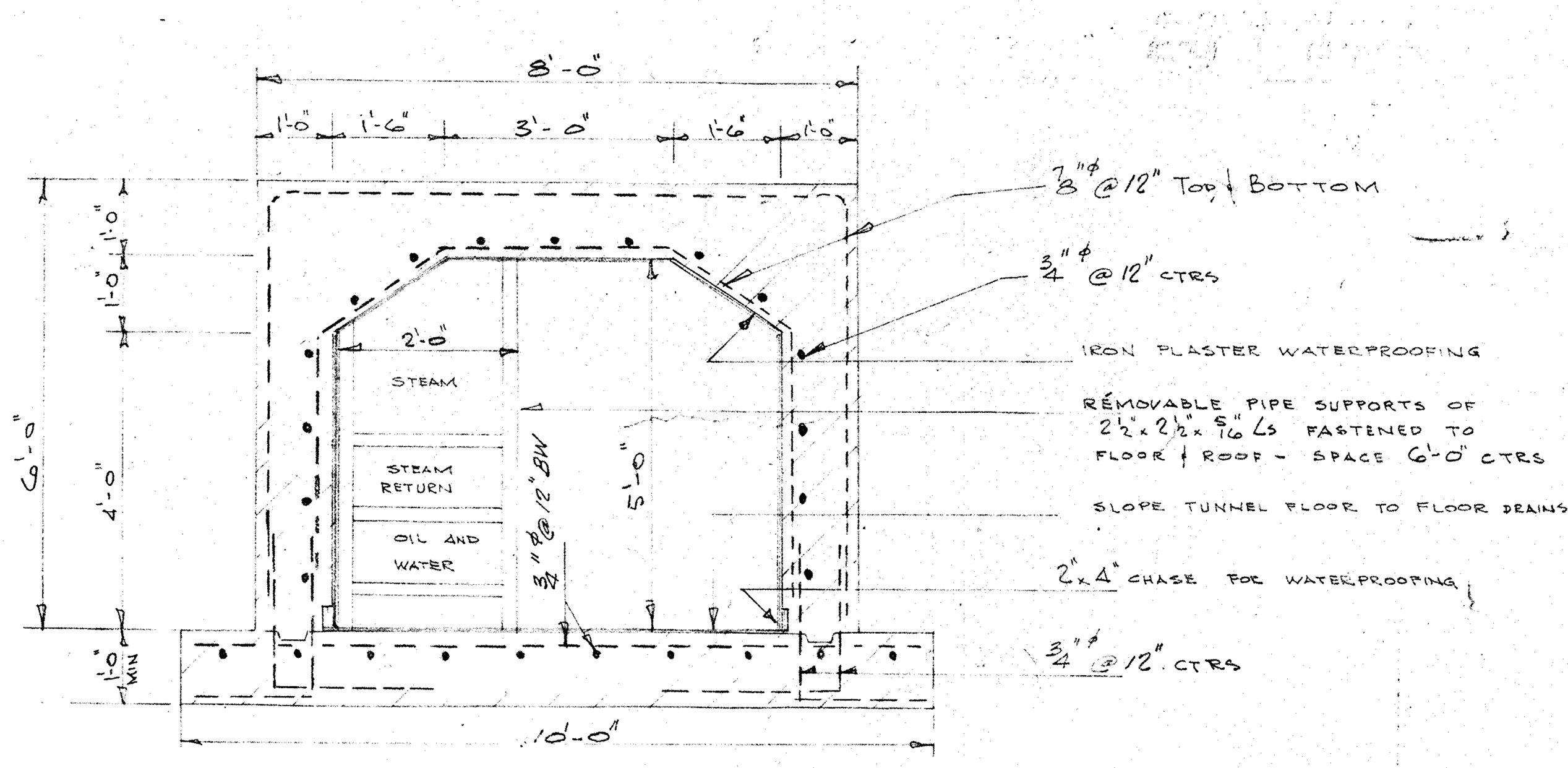
NOTES:

1. All concrete to be 2500 psi. quality
2. Foundation will be carried to solid soil and to a minimum of 5'-0" below Finished Floor
3. Gen. Contractor will set Anchor Bolts, Steel Plate Chip Screen, Outlet Box, all of which will be provided by the Owner
4. Drains & connections to same to be by Plumbing Contractor.
5. Owner will set machine and motors with his own resources

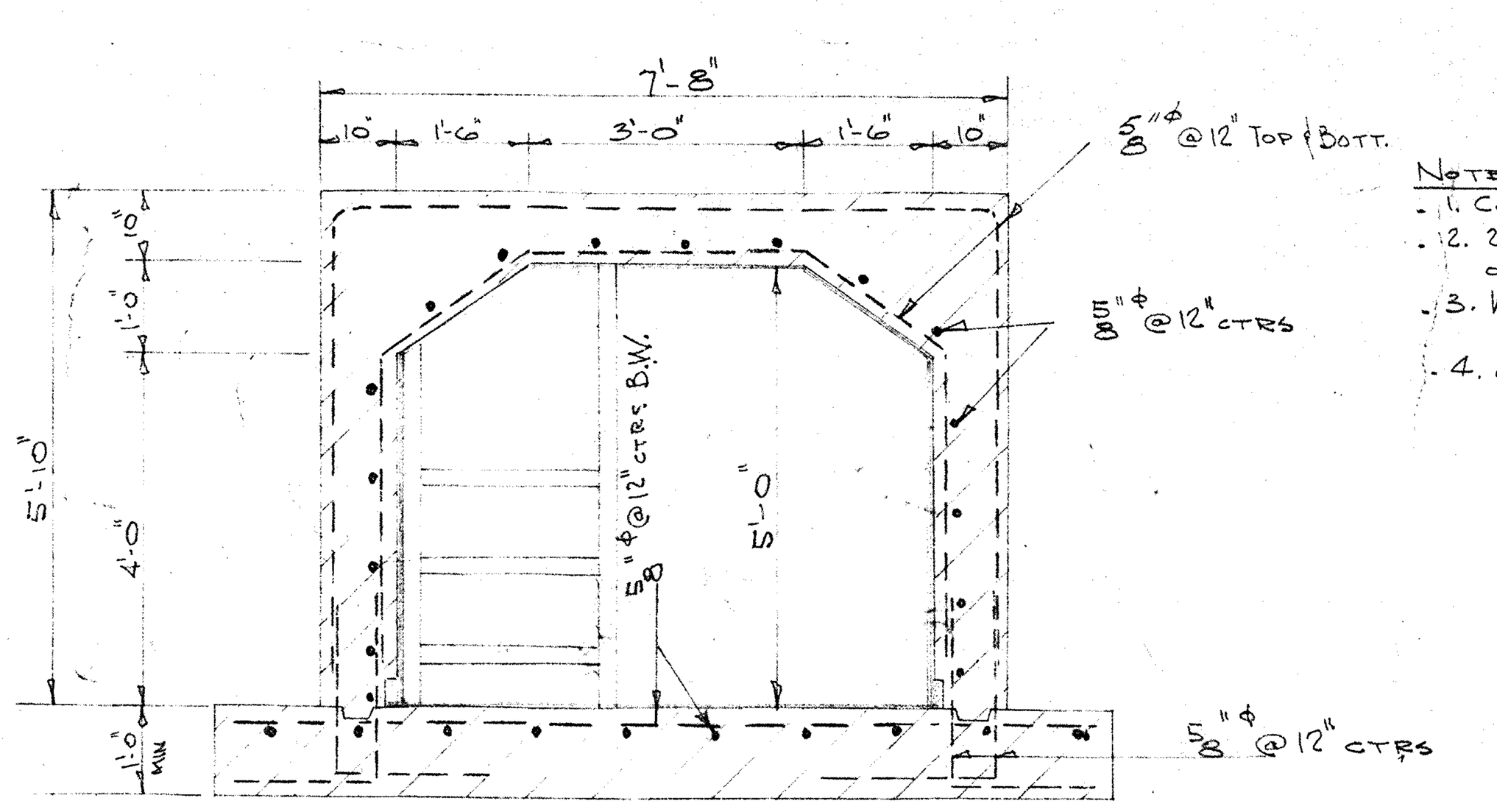
—FOUNDATION FOR 48 INCH BORING MILL— SCALE ½" = 1'-0"



PLAN of TUNNEL



—SECTION A-A—



NOTES:

1. Concrete of 2500 psi quality.
2. 2½" x 2½" x ¼" L edging about all openings anchored to concrete.
3. Where sewers pass under tunnel same are to be encased in concrete.
4. All reinforcing steel 2" cover.

SECTION B-B

SECTION B-B SIMILAR EXCEPT FOR DEPTH OF SECTION WHICH VARIES TO SUIT TUNNEL FLOOR ELEVATION, AND PIPING WHICH IS TO BE HUNG FROM TUNNEL ROOF.

—DETAILS OF SERVICE TUNNEL— SCALE ½" = 1'-0"

REF.	AMENDMENTS	DATE	BY
1	Dimensions of tunnel entrance revised	May 13/52	T.A.

ONTARIO NORTHLAND RAILWAY – NORTH BAY.

DIESEL SERVICE AND REPAIR SHOP
LUBRICATING OIL AND PARTS STORAGE BLDG
WHEEL REPAIR SHOP

MISCELLANEOUS FOUNDATIONS

SCALE: AS NOTED DATE: MARCH '51

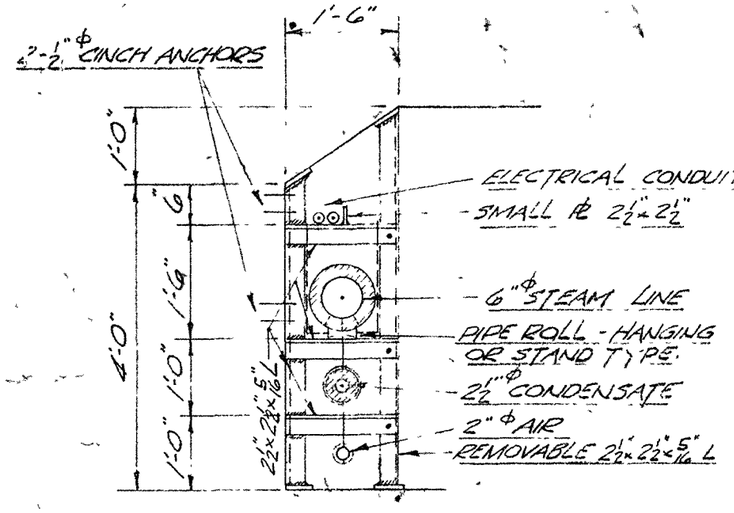
PROCTOR REDFERN & LAUGHLIN
CONSULTING ENGINEERS TORONTO

DRAWN P.A. Hertzberg
CHECKED J.F.W.
APP'D

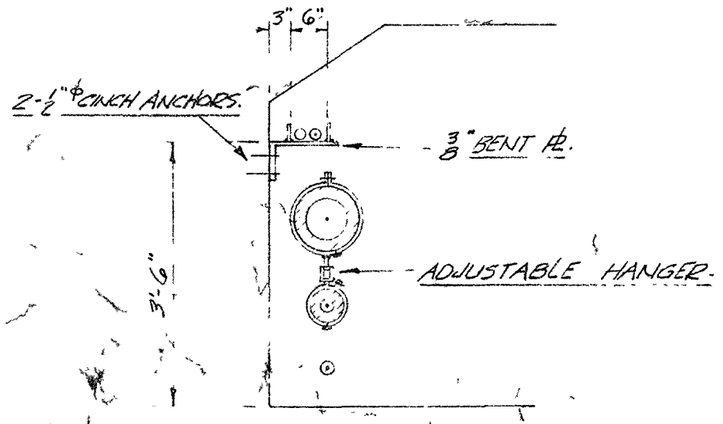
DRWG. Nº IA-197

1A-197x

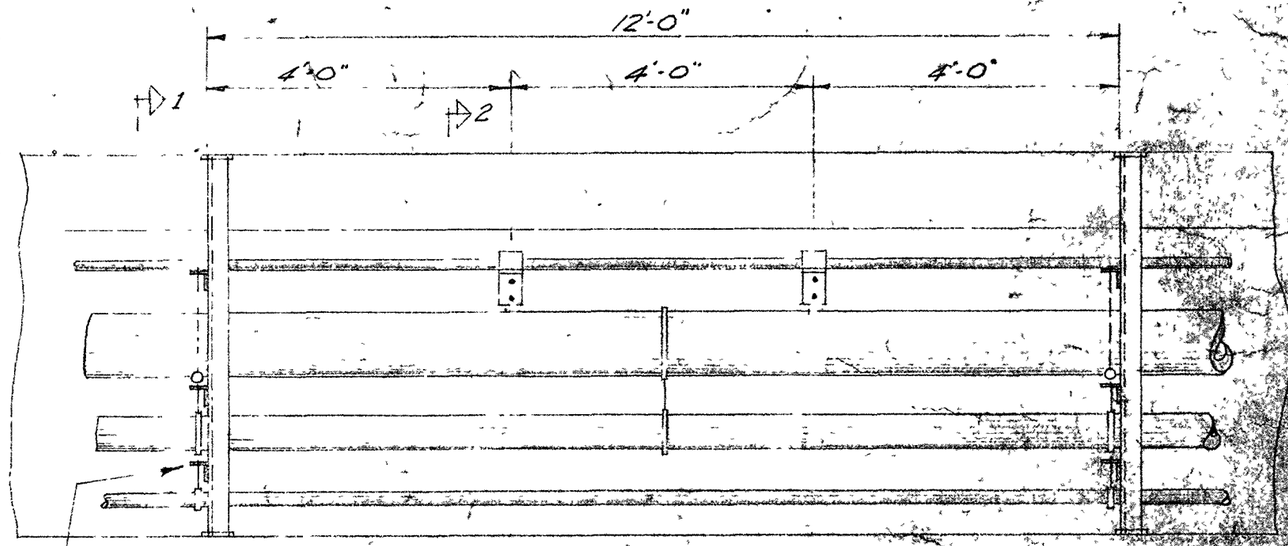
1A-197x



SECT. 1-1



SECT. 2-2



ELEVATION

NOTE:- L's WELDED TO VERT. WALL ANGLE & FIELD BOLTED TO OTHER VERT. ANGLE.

ONTARIO NORTHLAND RAILWAY
— NORTH BAY —

PIPING DETAILS IN TUNNEL

SCALE: ½" = 1'-0"	DATE: Feb. 12, 1952.
PROCTOR REDFERN & LAUGHLIN CONSULTING ENGINEERS TORONTO	
DRAWN BY: T.G.L.	DWG. NO. 1A-197
CHECKED BY: J.F.W.	