Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific Project will be returned without being examined and considered rejected.

.4 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.5 Verify field measurements and affected adjacent Work are co-ordinated.

.6 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator’s review of submittals.

.7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.

.8 Keep one reviewed copy of each submission on Site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit one (1) electronic copy of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

.2 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.3 Submit one (1) electronic copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within three (3) years of date of Contract award for project.

.4 Submit one (1) electronic copy of certificates for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of Project Contract complete with Project name.

.5 Submit one (1) electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.6 Submit one (1) electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.

.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.7 Submit one (1) electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.

.8 Delete information not applicable to Project.

.9 Supplement standard information to provide details applicable to Project.

.10 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.11 Contractor will be charged for Contract Administrator subsequent reviews of submittal packages exceeding two submissions.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Contract Administrator's business address.

.3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.

.6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

.1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.5 PROGRESS PHOTOGRAPHS

.1 Submit progress photographs.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Contract Administrator for purpose of inspecting and/or testing portions of Work.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to Contract Administrator. Pay costs for retesting and reinspection.

1.2 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off Site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.3 PROCEDURES

.1 Notify appropriate agency and Contract Administrator in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on Site. Provide sufficient space to store and cure test samples.

1.4 REPORTS

.1 Submit four (4) copies of inspection and test reports to Contract Administrator.

.2 Provide copies to Subcontractor of Work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.5 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute Work expeditiously.

.2 Remove from Site all such Work after use.

1.3 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of Work process to assure removal of harmful contaminants.

.6 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters.

.8 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Contract Administrator.

.9 Pay costs for maintaining temporary heat, when using permanent heating system. The City will pay utility charges when temporary heat source is existing building equipment.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

.1 Provide construction power and light panel board. Provide circuit breaker and cabling and connect to empty circuit in panel board with spare capacity.

.2 Provide and maintain temporary lighting throughout Project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.5 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone fax data hook up, lines, equipment necessary for own use.

1.6 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on Site.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-S269.2-[M1987(R2003)], Access Scaffolding for Construction Purposes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Indicate use of supplemental or other staging area.

.3 Provide construction facilities in order to execute Work expeditiously.

.4 Remove from Site all such Work after use.

1.4 HOISTING

.1 Provide, operate and maintain hoists, cranes required for moving of workers, materials and equipment.

.2 Hoists, cranes to be operated by qualified operator.

1.5 SITE STORAGE/LOADING

.1 Confine Work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.6 CONSTRUCTION PARKING

.1 Parking will be permitted on Site in public parking areas provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to Project Site including fire route access.

1.7 SECURITY

.1 Provide and pay for responsible security personnel to guard Site and contents of Site after working hours and during holidays.

1.8 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate Site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on Site in manner to cause least interference with Work activities.

1.10 SANITARY FACILITIES

.1 Provide sanitary facilities for Work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Contract Administrator.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from Site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.9 Dust control: adequate to ensure safe operation at all times.

.10 Provide snow removal during period of Work.

1.12 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from Work Site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material not in construction facilities.

1.13 FIRE ACCESS

.1 Maintain safe access for fire and rescue vehicles along south side of building.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from Site all such Work after use.

1.2 HOARDING

.1 Erect temporary Site enclosure.

.2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure and snow loading.

1.5 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such Work is complete.

1.6 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.7 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.8 FIRE ROUTES

.1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Contract Administrator locations and installation schedule three (3) days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of the City or separate Contractor.

.3 Include in request:

- .1 Identification of Project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of the City or separate Contractor.
- .7 Written permission of affected separate Contractor.
- .8 Date and time Work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of Project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering Work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.5 Remove samples of installed Work for testing.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry Work without prior approval.

.10 Restore Work with new products in accordance with requirements of Contract Documents.

.11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material with approved fire stopping assembly.

.13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

Part 2 Products NOT USED

Part 3 Execution NOT USED

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from Site at daily regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on Site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only and remove from Site.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-Site containers for collection of waste materials and debris.

.6 Dispose of waste materials and debris off Site.

.7 Clean interior areas prior to start of finishing Work, and maintain areas free of dust and other contaminants during finishing operations.

.8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after final inspection, with Contract Administrator's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four final copies of operating and maintenance manuals in English.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.7 Furnish evidence, if requested, for type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.9 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of Project and identify subject matter of contents.

.5 Arrange content by systems under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger Drawings to size of text pages.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project; Date of submission; names.

.1 Addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.

.2 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

.6 Training: refer to Section 01 79 00 - Demonstration and Training

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Condition, at Site for Contract Administrator one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Contract Administrator.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of drawings.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings mark each item to record actual construction, including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.

.5 Specifications; mark each item to record actual construction including:

- .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .2 Changes made by Addenda and change orders.

.6 Other Documents; maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.6 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.12 Additional requirements: as specified in individual specification sections.

1.7 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.8 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to Site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.9 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to Site; place and store.

.4 Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to Site; place and store. Receive and catalogue items. Submit inventory listing to Contract Administrator. Include approved listings in Maintenance Manual.

1.11 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator

1.12 WARRANTIES

.1 Assemble approved information in binder and submit upon acceptance of Work. Organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of applicable item of Work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties until time specified for submittal.

.2 Except for items put into use with City's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.3 Conduct joint 11 month warranty inspection, measured from Date of Substantial Performance, by Contract Administrator.

.4 Respond in a timely manner to oral or written notification of required construction warranty repair Work.

.5 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to City's personnel one week prior to date of substantial performance.

.2 The City will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct City's personnel, and provide written report that demonstration and instructions have been completed.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Contract Administrator approval. Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.3 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure amount of time required for instruction of each item of equipment or system is adequate as determined by the Contract Administrator.

.2 At a minimum allow for training of each system to two (2) separate groups of City personnel.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

1.2 EXISTING CONDITIONS

.1 Structures to be demolished to be based on their condition on date that tender is accepted.

.2 Items to be salvaged, as identified by City and/or City's Representative, to be carefully removed protected and handed to City and/or City's Representative.

1.3 DEMOLITION DRAWINGS

.1 Where required by authorities having jurisdiction, submit for approval Drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.

.2 Temporary supporting structures and shoring systems are to be designed and submittals sealed by a structural Engineer licensed to practice in the province of Manitoba.

1.4 PROTECTION

.1 Prevent movement, settlement or damage of adjacent structures, services, parts of existing building to remain. Provide bracing, shoring and underpinning as required. Make good damage caused by demolition.

.2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify the Department Representative or designate.

.3 Prevent physical intrusion and damage caused by environmental factors such as wind and rain and the spread of dust and contaminants by means of temporary plywood enclosures, screens, fencing, tarps and other means sealed against other areas of the building as required.

Part 2 Products

Part 3 Execution

3.1 PREPARATION

.1 Disconnect and re-route electrical and telephone service lines entering areas to be demolished in accordance with authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other areas of the building during period of demolition.

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.2 Disconnect and cap designated mechanical services in accordance with authorities having jurisdiction where indicated.

.3 Do not disrupt active or energized utilities designated to remain undisturbed.

3.2 DEMOLITION

.1 Demolish and remove in general portions of exterior and interior walls, roofing, ceilings, structures, finishes, fixed furnishings and mechanical and electrical components in the area of work that are not to be incorporated in the completed Project.

.2 At end of each day's Work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts to be demolished from exterior elements at all times.

.3 Demolish to minimize dusting.

.4 Do not sell or burn materials on Site.

.5 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

3.3 SALVAGE

.1 Items to be salvaged: As directed by Department Representative or designate.

.2 Carefully dismantle items containing materials for salvage and stockpile salvaged materials on Site.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete

.2 CAN/CSA-O86-14, Engineering Design in Wood.

.3 CSA O121-08(R2003), Douglas Fir Plywood.

.4 CSA O151-09 (R2014), Canadian Softwood Plywood.

.5 CSA O153-13 Poplar Plywood.

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

.7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.

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

.9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada.

.10 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 DESIGN REQUIREMENT

.1 Design of concrete formwork and all temporary shoring systems are responsibility of the Contractor.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 If requested, submit shop drawings for formwork and falsework signed and sealed by professional Engineer registered or licensed in the Province of Manitoba, Canada.

.3 If requested, submit WHMIS MSDS - Material Safety Data for product provided.

.4 Submit shop drawings indicating 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.

.5 If requested, submit shop drawings indicating formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect all materials and Work from frost and adverse weather.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.

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

.2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.

.1 Spiral pattern to show in hardened concrete.

.3 Steel forms: Minimum 1.9 mm well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection.

.4 Form ties:

.1 For concrete not designated 'Architectural', 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.

.5 Form liner:

.1 Plywood: medium density overlay Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151.

.6 Form release agent: non-toxic, biodegradable.

.7 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.

.8 Falsework materials: to CSA-S269.1.

.9 Sealant: to Section 07 92 10 - Joint Sealants.

.10 Void form: Moisture resistant Dynavoid® 40166 or approved equivalent for structural slab and Dynavoid® 40264 or approved equivalent for grade beams and pile caps. The void form must be structurally sufficient to support weight of wet concrete until final set.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with Drawings.

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

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

.4 Fabricate and erect falsework in accordance with CSA S269.1.

.5 Refer to architectural drawings for concrete members requiring architectural exposed finishes. Do not apply form release agent where concrete surfaces are to receive special finishes that are affected by the agent.

.6 Apply form release agent on formwork in accordance with manufacturer's recommendations prior to placing reinforcing steel, anchoring devices, and embedded parts.

.7 Erect formwork to result in exposed concrete surfaces free of unsightly cold joints, blemishes, bug holes, honeycombing and cracking.

.8 Provide bracing to ensure stability of formwork.

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

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

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

.12 Align form joints and make watertight.

.1 Keep form joints to minimum.

.13 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.14 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.15 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

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

.17 Ensure piles Project into grade beams and pile caps as indicated on Drawings.

.18 Remove all loose concrete from tops of piles. Ensure tops of piles are sound concrete.

.19 Construct formwork to maintain the following maximum tolerances:

.1 Horizontal and vertical lines – 10 mm in 20 m.

.2 Building dimensions and position of columns, walls, partitions: 6 mm.

.3 Cross sectional dimensions of columns or beams: ±3 mm.

.4 Camber, beams: 0.2% of span.

.5 Camber, slabs: 0.1% of span for all spans over 3 m.

.20 Do not re-use formwork that contains surface defects that could impair the appearance of finished concrete.

.21 Do not patch formwork.

3.2 REMOVAL AND RESHORING

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

.1 Three (3) days for walls and sides of beams.

.2 Five (5) days for beam soffits, slabs, and other structural members, or three (3) days when replaced immediately with adequate shoring to standard specified for falsework.

.2 Provide necessary reshoring 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 reshoring in each principal direction at not more than 3000 mm apart.

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

.5 Do not wedge pry bars or hammers against concrete surfaces.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 SP-66-04, ACI Detailing Manual 2004.

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

.3 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

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

.5 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.6 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.7 CAN/CSA-A23.3-14, Design of Concrete Structures.

.8 CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.

.9 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.10 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

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

.12 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.

.13 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SHOP DRAWINGS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice SP-66.

.3 Details in accordance with ACI 315 unless specifically detailed otherwise.

.4 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative with identifying code marks to permit correct placement without reference to structural drawings.

.5 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

.5 Unless noted otherwise on Drawings, bar splices to be 40 bar diameters or 400 mm minimum for horizontal slices and 30 bar diameters or 350 mm minimum for vertical splices.

.6 Provide corner bars at corners and intersections of grade beams and walls, in accordance with the structural drawings.

.7 Include details of all doweling.

.8 All shop drawings to be reviewed and checked by the Contractor prior to submission to the Contract Administrator.

.9 Review of shop drawings by the Contract Administrator in no way relieves the Contractor responsibility for the accuracy of the shop drawings.

1.4 QUALITY ASSURANCE

.1 If requested, submit two copies of the following:

.1 Mill Test Report: upon request, provide certified copies of mill test report of reinforcing steel, minimum four (4) weeks prior to beginning reinforcing Work.

.2 Perform welding to CSA W186.

.3 Welders qualified under CSA W47.1.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store materials off ground in clean, dry, and well-ventilated area.

.2 Protect materials from deterioration or contamination.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by the Contract Administrator.

.2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

.5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.

.6 Welded steel wire fabric: to ASTM A185/A185M.

.1 Provide in flat sheets only.

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

.8 Tie wire: minimum 1.5 mm annealed type, or patented system approved by the Contract Administrator.

.9 Mechanical splices: subject to approval of the Contract Administrator.

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

.11 Galvanized reinforcement: to ASTM A123/A123M, minimum zinc coating 610 g/m^3.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Locate the reinforcement splices at points of minimum stress. Location of splices to be approved by the Contract Administrator.

.3 Upon approval of the Contract Administrator or the Engineer of Record, weld reinforcement in accordance with CSA W186. Do not weld reinforcing at any location without written approval of the Contract Administrator.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

.5 Do bending cold unless approved by the Contract Administrator.

.6 Dowels columns and walls into foundations using the same reinforcing as that in columns and walls unless noted otherwise on Drawings.

.7 Provide horizontal L shape corner bars of same cross section and spacing as horizontal bars in walls and grade beams.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel in accordance with the reviewed shop drawings and/or contract drawings.

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

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

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

.3 Cleaning reinforcing to CSA A23.1.

.4 Support and space reinforcement in alignment and position as follows:

.1 Concrete slab on grade: support reinforcement on support bars or concrete brick.

.2 Concrete structural slab and topping: support reinforcement on bar chairs.

.3 Provide minimum clear cover as follows unless detailed on Drawings:

Concrete Cover

Exposure condition	Exposure class		
	N	F-1, F-2, S-1, S-2	C-XL, C-1, C-3, A-1, A-2, A-3
Cast against and permanently exposed to earth (foundations and piles)	-	75 mm	75 mm
Formed surfaces exposed to earth (piers, pile caps, grade beams, foundation walls, retaining walls)	40 mm	40 mm	60 mm
Slabs, walls, joints, stoops	20 mm	40 mm	60 mm
Sidewalks, curbs and gutters, splash pads and sump pits	-	-	30 mm
Ratio of cover to nominal bar diameter	1.0	1.5	2.0
Ratio of cover to nominal maximum aggregate size	1.0	1.5	2.0

.5 Place reinforcing to CSA A23.1. Refer to structural Drawings for minimum splices. Splices to be class B unless noted otherwise.

.6 Use non-corrosive supports for reinforcing when concrete is exposed.

.7 Support chairs to not exceed 1200 mm spacing.

.8 Do not re-bend or straighten reinforcing steel after initial fabrication.

.9 Ensure reinforcement does not move during concrete pour.

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

.11 Ensure minimum cover to reinforcing steel for fire rating as specified on the Drawings.

3.3 FIELD QUALITY CONTROL

.1 The Contract Administrator will periodically visit the Site.

.2 Field services by the Contract Administrator do not in any way relieve the Contractor’s responsibility to carry out Work as specified in the Contract documents.

.3 Notify the Contract Administrator for an inspection 24 hours prior to concrete placement. Correct all identified deficiencies prior to pour.

.4 Contractor is responsible for reinforcing size, location and proper placement.

.5 Remove and replace reinforcement not in accordance with the drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 ASTM C260/C260M-10a, 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-15a, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412-15a2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624-00 (2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D1751-04 (2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.8 ASTM D1752-04a (2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

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

.10 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.11 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

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

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

1.3 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.1 Type GU, GUb and GUL - General use cement.

.2 Type MS and MSb - Moderate sulphate-resistant cement.

.3 Type MH, MHb and MHL - Moderate heat of hydration cement.

.4 Type HE, HEb and HEL - High early-strength cement.

.5 Type LH, LHb and LHL - Low heat of hydration cement.

.6 Type HS and HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 15%.

.2 Type CI - with CaO content ranging from 15 to 20%.

.3 Type CH - with CaO greater than 20%.

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

1.4 DESIGN REQUIREMENTS

.1 Contractor shall be responsible for design of concrete formwork and shoring systems.

1.5 SHOP DRAWINGS AND SUBMITTALS

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

.2 If requested, at least (four) 4 weeks prior to beginning Work, provide test data and certification by a qualified and independent inspection and testing laboratory that following materials will meet specified requirements:

.1 Joint filler.

.2 Waterstops.

.3 Supplementary cementing material.

.4 Blended hydraulic cement.

.5 Admixtures.

.6 Fine and coarse aggregates.

.3 Submit all concrete mix designs to the Contract Administrator for review two (2) weeks prior to beginning Work.

.4 Do not proceed without written approval when deviations from mix design or parameters are found.

.5 Submit shop drawings indicating proposed location and details for all construction joints to the Contract Administrator for review prior to concrete pour.

.6 Provide two (2) copies of WHMIS MSDS.

1.6 QUALITY ASSURANCE

.1 If requested, provide the Contract Administrator, minimum (four) 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

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

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

.1 Hot weather concrete.

.2 Cold weather concrete.

.3 Curing.

.4 Finishes.

.5 Joints.

.3 The Contractor shall arrange and pay for tests to be performed by a testing laboratory approved by the City or the Contract Administrator. The tests shall include the following:

.1 Concrete tests:

.1 One set of 3 standard test specimens to be made for each class of concrete in any one day pour of more than 5 cubic meters for compressive strength tests.

.2 For pours of more than 60 cubic meters, add one set per each additional 60 cubic meters for compressive strength tests.

.3 For Work containing less than 5 cubic meters, one set of three (3) standard test specimens shall be prepared for compressive strength tests.

.4 For cold weather concrete, one additional standard test specimens shall be prepared and cure the specimens on site under same conditions as concrete it represents for compressive strength tests.

.5 Concrete for tests to be sampled at the point of deposit of the concrete into the forms.

.6 Test specimens shall be cast, cured, and tested in accordance with CSA A23.2 by personnel from the testing laboratory.

.7 For each set of test specimens, a slump test and air content test (for air entrained concrete) shall be included.

.2 Test result reports shall include:

.1 Project name.

.2 Date and time of sampling.

.3 Date specimens received in the laboratory.

.4 Supplier, truck number, and time that concrete truck departs from the plant.

.5 Specified strength, slump, maximum aggregate, and air content.

.6 Cement type.

.7 Admixtures.

.8 Exact location in structure of sampled specimens.

.9 Slump.

.10 Maximum aggregate size.

.11 Air content, if applicable.

.12 Concrete strength and age at test.

.13 Technical information such as fails, curing, etc.

.3 Concrete will be considered satisfactory if the strength test result is no more than 3.5 MPa below the specified strength.

.4 Failure to comply with the requirements of this specification will result in the structure being considered potentially deficient. In such case, the City or Contract Administrator shall have the right to require one or more of the following:

.1 Changes in the mix proportions for the remainder of the Work.

.2 Additional curing on those portions of the structure represented by test specimens that failed to meet specified requirements.

.3 Non-destructive testing of concrete: to CSA A23.1/A23.2.

.4 Test cores drilled from portions of the structure in question in accordance to CSA A23.2.

.5 Load testing of the structure or structural element in question in accordance with CSA A23.3.

.6 Reinforce by additional construction or replace as directed by the Contract Administrator at the Contractor's expense when concrete is judged inadequate by structural analysis or be results of load tests.

.7 Such other tests as the City or the Contract Administrator may specify.

.8 Note that cores should not be drilled from the tension zone of a structural member.

.9 The Contractor pay for all costs of evaluation tests and additional engineering analysis that are required to demonstrate the adequacy of the structure where it does not meet the requirements of this specification and Drawings or where concrete has been placed before formwork and reinforcement have been inspected and approved.

.5 Do not use contaminated materials.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching. Reject all concrete with hauling time exceed 120 minutes.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

.2 Store and protect materials from damage by frost and weather.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Provide appropriate area on job site where concrete trucks and be safely washed.

.2 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site.

.3 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.

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

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

.6 Clean up and remove all rubbish and surplus materials from site.

Part 2 Products

2.1 MATERIALS

.1 Portland Cement: to CSA A3001.

.1 Concrete piles to have CSA Type 50 sulphate resistant cement.

.2 Concrete:

.1 Concrete shall have nominal compressive strength and meet the requirement for hardened concrete as specified in the following table.

EXP. CLASS	SUPPLY AND USE	MAX W/C	STRENGTH	CEMENT TYPE	SLUMP	MAX AGG. SIZE	AIR ENTRAINMENT	MAX FLY ASH CONTENT
S-1	FOUNDATION SLAB	0.4	35MPa @28 DAYS	HS	100 mm ±20 mm	19 mm	5%-8%	25%

.3 Water: to CSA A23.1.

.4 Aggregates: to CSA A23.1/A23.2.

.5 Admixtures:

.1 Air entraining admixture: to ASTM C260.

.2 Chemical admixture: to ASTM C494 ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.

.3 Do not use Calcium Chloride or any admixture containing Chloride iron.

.4 Admixtures must be used in strict accordance with the manufacturer's instruction.

.6 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.

.7 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 50 MPa at 28 days.

.8 Waterstops: ribbed extruded PVC of sizes indicated with shop welded corner and intersecting pieces:

.1 Tensile strength: to ASTM D412, method A, Die "C".

.2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.

.3 Tear resistance: to ASTM D624, method A, Die "B", minimum 30 kN/m.

.9 Premoulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.10 Polyethylene film: 10 mm to CAN/CGSB-51.34.

.11 Bonding adhesive: Polymer resin emulsion, for mixing with cement and water. For bonding two concretes: to CSA A23.1.

.12 Curing compound: Chlorinated liquid rubber type, membrane forming.

.13 Do not change concrete mix or source material without written approval of the Contract Administrator.

Part 3 Execution

3.1 PREPARATION AND CONCRETE PLACEMENT

.1 Notify the Contract Administrator 24 hours prior to placing of concrete.

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

.3 Prior to placing of concrete submit a proposed method for protection of concrete during placing and curing in adverse weather to the Contract Administrator for approval.

.4 Use cold weather concrete, curing protection methods in accordance with CSA A23.1 when the ambient temperature falls below 5^{o}C.

.5 When the ambient temperature rises above 25^{o}C, use hot weather concrete, curing and protection methods.

.6 During concreting operations:

.1 Development of cold joints not allowed.

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

.7 Clean previously placed concrete with steel brush and dampen prior to placing the next layer.

.8 Protect previous Work from staining.

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

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

.11 Place concrete in approximately horizontal layers such that each lift can be vibrated into the previous lift.

.12 Place concrete directly into its final position in forms. Do not spread concrete with vibrators.

.13 Maximum vertical free fall of concrete shall not exceed 1200 mm in unexposed Work or 800 mm in exposed Work. Confine concrete with a suitable vertical drop pipe to prevent segregation.

.14 Place concrete as a continuous operation, stopping only at construction joints indicated on the Drawings or approved proposed locations.

.1 At centre of span of structural suspended slab, beams, and joists.

.2 Immediately above or below floor construction joints in walls and columns.

.3 Maximum spacing of 12 m in walls and grade beams.

.4 Construction joints in walls must be watertight.

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

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

.17 Do not place load upon new concrete until authorized by the Contract Administrator.

.18 Honeycombing or embedded debris in concrete that exceed 150 mm in any direction are not acceptable. Notify the Contract Administrator upon discovery of such defects.

.19 Remove and replace defective concrete as directed by the Contract Administrator.

3.2 INSTALLATION/APPLICATION

.1 Perform cast-in-place concrete Work to CSA A23.1/A23.2.

.2 Sleeves and inserts:

.1 Provide formed openings where required for pipes, conduits, sleeves and other embedded passing through concrete members.

.2 Sleeves and openings greater than 100 × 100 mm not indicated on Drawings must be reviewed by the Contract Administrator.

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

.4 Maximum size of electrical conduit in structural slab is 1/3 of slab thickness and the conduit shall be located within middle third of the thickness.

.5 Where there are more than two conduits adjacent to each other in structural slab, they shall be separated with at least 100 mm spacing.

.6 Confirm locations and sizes of sleeves and openings shown on Drawings.

.7 Do not use aluminum inserts or conduits.

.3 Anchor bolts:

.1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete. No wet set is allowed.

.2 Grout anchor bolts in preformed holes drilled after concrete has set only with written approval or specified in the Drawings.

.1 Formed holes: 100 mm minimum diameter.

.2 Drilled holes: to manufacturers' recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Set bolts and fill holes with epoxy grout.

.5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.4 Drainage holes and weep-holes:

.1 Form weep-holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.2 Install weep hole tubes and drains as indicated.

.5 Finishing and curing:

.1 Curing concrete to CSA A23.1.

.2 Basic curing: keep concrete surface continuously moist until concrete temperature due to hydration has peaked and dropped several degrees, or for three (3) days at a minimum temperature of 10°C.

.3 Additional curing: immediately following basic curing and before concrete has dried, cure for an additional four (4) days, maintaining the temperature of the air in contact with concrete above 10°C.

.4 Acceptable curing methods:

.1 Ponding or continuous sprinkling.

.2 Absorptive mat or fabric kept continuously wet.

.3 Damp sand, earth, or similar moist materials.

.4 Continuous steam vapour mist bath not exceeding 70°C.

.5 Curing compound.

.6 Waterproof paper or plastic film.

.7 Other moisture-retaining method approved by the Department Representative.

.5 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

.6 Finish concrete floor to CSA A23.1/A23.2.

.7 Concrete floor to have finish hardness equal to or greater than Mohs hardness to CSA A23.1/A23.2.

.8 Provide float finish unless otherwise indicated.

.9 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.10 Protect freshly placed concrete against damage from adverse weather conditions.

.11 Exposed concrete walking surfaces not to receive an integral hardener: coat with curing compound of curing method that provides permanent seal.

.12 In areas with an exposed concrete floor surface, apply the hardener and dust-proofing agent strictly to the manufacturer's instruction.

.13 Water for curing shall be clean and free from contamination or discoloring agent.

.14 If moist curing is not used, then sprayed curing compounds are to be used.

.15 Curing compounds.

.16 Do not use curing compound on concrete surfaces that are expected to receive topping or other type of bonded finish.

.17 Curing compounds to be of liquid membrane type and shall be applied in strict accordance with the manufacturer's instructions.

.18 Curing compounds used for exposed concrete must not discolor the concrete.

.19 Apply sprayed curing compounds on horizontal surfaces immediately after the disappearance of surface moisture.

.6 Waterstops:

.1 Install waterstops to provide continuous water seal.

.2 Do not distort or pierce waterstop in way as to hamper performance.

.3 Do not displace reinforcement when installing waterstops.

.4 Use equipment to manufacturer's requirements to field splice waterstops.

.5 Tie waterstops rigidly in place.

.6 Use only straight heat sealed butt joints in field.

.7 Use factory welded corners and intersections unless otherwise approved by the Contract Administrator or the Engineer of Record.

.7 Joint fillers:

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

.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.

.8 Grouting:

.1 Grout beneath steel base and bearing plates after the steel has been erected. This grout is to be expanding type and be mixed and placed as per the manufacturer's instruction.

3.3 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1 Straightedge Method FF = 25: FL = 20.

.2 Variation of linear building lines from established position in plan: 6 mm.

.3 Variation in cross-sectional dimensions: ±6 mm.

.4 Variation from the level or from grades indicated for surfaces of slab shall not exceed 3 mm in a 3 m straight edge immediately after trowelling.

.5 Remove and replace concrete that does not meet the requirement at no additional cost to the City.

3.4 PROTECTION

.1 Protection for concrete to CSA A23.1.

.2 Protect fresh concrete from adverse weather conditions. All forms and reinforcing in contact with fresh concrete must have surface temperature of greater than $5^{o}C$.

.3 Do not place concrete on frozen ground.

.4 Do not place concrete on soil that is subjected to change in moisture. Soil must be either all dried or wetted so that its moisture content is normal and equal to that of the surrounding soil.

.5 Provide and use tarpaulins or other protection material when necessary to completely cover or enclose all freshly placed concrete.

3.5 FIELD QUALITY CONTROL

.1 The Contract Administrator will periodically visit the site.

.2 Field inspection by the Contract Administrator does not in any way relieve the Contractor of his contractual responsibility.

3.6 HOT WEATHER CONCRETE

.1 When the ambient temperature is at or above $25^{o}C$ or when there is a probability that the ambient temperature rising to or above $25^{o}C$ during concrete placement, the temperature of concrete when deposited is not to be more than $25^{o}C$. To accomplish this, the mixing water, if necessary the aggregate, is be cooled.

.2 When pour are massive or where surfaces are to be trowel finished, or wood floated, use a retarder that will slow the initial set of the concrete.

.3 When the ambient temperature is at or above $25^{o}C$, exposed surface of the concrete are to be shaded from direct sun ray and sheltered from direct wind.

.4 Moist cure concrete instead of using curing compounds.

3.7 COLD WEATHER CONCRETE

.1 When the ambient temperature is at or below $5^{o}C$ or when there is a probability that the ambient temperature dropping to or below $5^{o}C$ during concrete placement, the temperature of concrete during placing shall be between $15^{o}C$ and $25^{o}C$.

.2 Placed concrete shall be protected and maintained at a temperature of at least $10^{o}C$ for not less than three (3) days or not less than $20^{o}C$ for two (2) days and all concrete to be maintained above freezing for a minimum of seven (7) days.

.3 Concrete shall be protected from alternate freezing and thawing for a minimum of fourteen (14) days.

.4 Protected and heated concrete to be brought gradually to ambient air temperature at a drop of not more than $15^{o}C$ per 24 hour period.

.5 Heating enclosure shall be clear of concrete and forming surfaces for air circulation.

.6 Frozen concrete will be rejected.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A193/A193M-16, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 psi Tensile Strength.

.4 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.5 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric).

.6 ASTM F3125/F3125M-15a, Standard Specification for High-Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

.7 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.8 Handbook of Steel Construction, 11th Edition (2016).

.9 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.10 CISC/CPMA 2-75, Quick-Drying, Primer for use on Structural Steel.

.11 CAN/CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.12 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.13 CAN/CSA-S16-14, Design of Steel Structures.

.14 CAN/CSA-S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members.

.15 CAN/CSA-S136.1-12, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

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

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.17 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.18 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.

.19 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.20 MPI-R2012, Architectural Painting Manual.

.21 MPI-R2012, Maintenance Repainting Manual: Interior Repainting.

.22 MPI-R2012, Maintenance Repainting Manual: Exterior Repainting.

.23 The Society for Protective Coatings (SSPC)

1.3 DESIGN REQUIREMENTS

.1 Design components, details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated on Drawings, and otherwise.

.2 Design shear connections to develop shear capacity of member being connected and show details on Shop Drawings.

.3 Design moment connections to develop moment capacity of member being connected and show details on Shop Drawings.

.4 Design all temporary bracings as required for structural stability during construction stages.

.5 Design all bolt connections with a minimum two bolts in a connection.

.6 Submit sketches and design calculations signed and sealed by a Professional Engineer registered in the Province of Manitoba for non-standard connections.

1.4 SHOP DRAWINGS

.1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 – Submittal Procedures.

.2 Erection drawings shall include details and information necessary for assembly and erection purposes, framing plans and grid lines, bearing details, framed openings, accessories, schedule of materials, camber and loading, fasteners and welds, and required temporary bracing.

.3 Additional erection drawings including sequence of erection and type of equipment used in the erection may be required.

.4 Ensure Fabricator drawings showing designed assemblies, components and connections are signed and sealed by a Professional Engineer registered in the Province of Manitoba.

.5 All shop drawings to be reviewed and checked by the Contractor prior to submission to the Contract Administrator.

.6 Review of shop drawing by the Contract Administrator in no way relieves the Contractor responsibility for the accuracy of the shop drawings.

.7 Specify primer to be used for each member and components.

.8 Fabricator is to certify that all connection design and details including erection procedure have been supervised and carried out by a Professional Engineer registered in the province of Manitoba.

1.5 QUALITY ASSURANCE

.1 If requested, submit two (2) copies of mill test reports two (2) weeks prior to fabrication of structural steel.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in Project.

.2 Provide mill test reports certified by metallurgists qualified to practice in Canada.

.2 If requested, provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

.3 Submit welder’s Certificates.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused metal materials to metal recycling facility.

.2 Divert unused paint material to hazardous material collections facility.

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

.4 Clean up and remove all rubbish and surplus materials from site.

Part 2 Products

2.1 MATERIALS

.1 Structural steel: to CAN/CSA-G40.20/G40.21 (or ASTM A36/A36M) Grade 350W for rolled section and Grade 300W for plates and angles.

.2 Cold-formed structural members: to CAN/CSA-S136.

.3 Anchor bolts: to CAN/CSA-G40.20/G40.21 Grade 300W.

.4 High strength anchor bolts: to ASTM A193/A 93M.

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.5 Bolts, nuts and washers: to ASTM A325/A325M.

.6 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.7 Primer: to CISC/CPMA1 for interior steel and to CISC/CPMA2 for exterior steel.

.8 Hot dip galvanizing: galvanize steel, for exterior steel and for where indicated, to CAN/CSA-G164, minimum zinc coating of 700 g/m^2.

.9 Shear studs: to CSA W59, Appendix H.

2.2 FABRICATION

.1 For rehabilitation and remediation projects, verify dimensions prior to commencing fabrication.

.2 Fabricate structural steel in accordance with CAN/CSA-S16 and/or CAN/CSA-S136.

.3 Weld to CSA W59.

.4 Joint surfaces to be free from fins and tears.

.5 Install shear studs in accordance with CSA W59.

.6 Continuously seal members by continuous welds where indicated. Grind smooth.

.7 Seal all hollow structural sections with suitable cap plates or by welding all around to adjoining members.

.8 Splice members are not allowed unless noted otherwise or with a written consent of the Contract Administrator. Where spliced, reliable non-destructive inspection such as X-ray is mandatory to ensure the splice workmanship and at the contractor's expense.

.9 Weld threaded studs to top flanges for attachment of wood nailers.

.10 Clean, prepare surfaces in accordance with SSPC and prime structural steel in accordance with MPI except where members to be encased in concrete.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: to CAN/CSA-S16 and/or CAN/CSA-S136.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

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3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

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

3.4 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and/or CAN/CSA-S136 and in accordance with approved reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Contract Administrator.

.3 Provide all temporary bracings.

.4 Fix and attach all members and bracing by means of field welding.

.5 Continuously seal members by continuous welds where indicated. Grind smooth.

.6 Level, plumb and align all members to CAN/CSA S16.

.7 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.8 Galvanize all exterior structural steel components and all noted or specified components to ASTM A123/A123M.

.9 Weld all anchors required to restrain concrete masonry walls.

.10 Correct to acceptance all errors in member fit and erection.

.11 Do not place holes or openings in structural members without the approval of Contract Administrator. Provide reinforcing plates around all openings to maintain design strength where approval is granted.

.12 Frame all openings in steel deck exceeding 400 mm across the flutes.

.13 Provide steel plates, shelf angles, including anchors, required to support steel deck on masonry walls.

3.5 FIELD QUALITY CONTROL

.1 The Contract Administrator, and/or the City will periodically visit the site.

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.2 Field services by the Contract Administrator do not in any way relieve the Contractor's responsibility to carry out work as shown in the Contract documents.

.3 Inspection of materials and workmanship to be carried out by an independent inspection and testing firm certified in accordance with CAN/CSA W178.1 retained and paid for by the Contractor and approved by the Contract Administrator.

.4 An independent inspection shall include:

.1 Visual inspection of all welds and workmanship that are readily accessible.

.2 Random check of structural steel member sizes and steel deck gauge.

.3 Other non-destructive tests, if required.

.4 Review welder's certificates and welding procedure.

.5 Inspect all puddle welds and side lap crimping of accessible steel decking.

.6 Confirm acceptable coatings.

.7 Tracking all noted deficiencies and providing report to all relevant parties.

.8 A final report sealed and signed by a Professional Engineer registered in the province of Manitoba where the work is located certifying that all welds and connections, including confirmation that required repairs have been completed.

.5 Provide safe access and working areas for testing and inspection on site, as required by testing agency and/or the Contract Administrator.

.6 Submit mill test reports to Contract Administrator, upon request.

.7 The Contractor will pay costs of inspection and testing, re-inspection as a result of defective workmanship, and repairs to correct defective work.

.8 Additional inspection or test may be requested by the Contract Administrator. The cost associating with approved additional inspections or tests to be paid for by the Contractor.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 09 91 00 – Painting.

1.2 REFERENCES

.1 National Building Code of Canada (NBC).

.2 Manitoba Building Code (MBC).

.3 American Society for Testing and Materials International, (ASTM).

.1 ASTM A325-09, Specification for Structural Bolts, Steel, Heat Treated, 60,000 PSI Tensile Strength, galvanized.

.4 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.5 Canadian Standards Association (CSA International).

.1 CAN/CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel.

.2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-S16.1-09, Limit States Design of Steel Structures.

.4 CAN/CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.

.5 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.6 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding) (Imperial Version).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Shop Drawings and Submittals.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Shop Drawings and Submittals. Indicate VOC's:

.1 For finishes, coatings, primers and paints.

.2 Shop Drawings.

.1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 – Submittal Procedures.

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.2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:

.1 Description of methods.

.2 Sequence of erection.

.3 Type of equipment used in erection.

.4 Temporary bracings.

.5 All information necessary for fabrication of component parts, including extent of shop paint coverage.

.6 Wall Plate and Anchor Bolt Details and Setting Out Plan.

.7 Location and size of all members and details of field connections.

.3 Ensure each drawing submitted bears stamp and signature of qualified Professional Engineer registered or licensed to practice in the province of Manitoba.

1.4 QUALITY ASSURANCE

.1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material and pallets in appropriate on-site containers for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to an approved metal recycling facility.

Part 2 Products

2.1 MATERIALS

.1 Steel sections: to CAN/CSA-G40.20/G40.21, Grade 350W.

.2 Hollow structural sections: to CAN/CSA G40.20/G40.21, Grade 350W, Class C.

.3 Angles, channels and plates (L, C): to CAN/CSA G40.20/G40.21, Grade 300W.

.4 Welding materials: to CSA W59.

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.5 Welding electrodes: to CSA W48 Series.

.6 Bolts and anchor bolts: to ASTM A325.

.7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

.8 Structural aluminum: to 6063-T6 or 6351-T6 alloy, mill finish, unless otherwise noted.

.9 Stainless steel: grade 304, mill finish.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble Work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

.5 Detailing of connections for members framing into concrete walls shall allow horizontal adjustment of connection angles.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating to CAN/CSA-G164.

.2 Shop coat primer: to CAN/CGSB-1.40.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181. suitable for final finish as specified in Section 09 91 00 Painting and Protective Coatings.

2.4 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized, stainless steel or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.

.3 Clean surfaces to be field welded; do not paint.

2.5 STEEL PIPE RAILS AND KICK PLATES

.1 Supply and install all pipe rails to locations shown on the Drawings. Design pipe rails and anchorage of system to accommodate loadings required by code.

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.2 Fabricate pipe rail of standard weight ANSI Schedule 40 steel pipe, 48.3 mm of, mill finish, with intermediate horizontal rails and vertical posts at not more than 1500 mm centres.

.3 Height of top rail to be 1070 mm above floor or landing level with intermediate rail at midpoint or as detailed.

.4 Provide at least 50 mm clearance between every handrail and any wall to which it is fastened.

.5 Pipe rails shall be fabricated with all joints neatly and accurately fitted, welded and buffed smooth.

.6 Provide anchor plates welded to posts for side anchored railing sections, predrilled for fasteners.

.7 Provide 6mm thick by 150 high kick plates welded to steel posts or guards at perimeter of openings through the floor and at elevated platforms.

2.6 STEEL LADDERS

.1 Supply and install all vertical steel ladders where shown and as detailed on the Drawings. Ladder shall be 460 mm wide, of all welded construction, with burrs and sharp edges removed and welds ground smooth.

.2 Ladders to be profile and dimensions shown on the Drawings.

.3 Rungs to be solid steel of diameter indicated, welded into steel rails. Grind welds smooth and flush with outside surface of ladder rails.

.4 Anchor ladders at minimum 150 mm from the face of any wall surface by means of steel plate brackets.

.5 For concrete and masonry surfaces, space brackets at maximum 1500 mm centres or as detailed, drill wall and secure brackets with 16 mm diameter anchors of type specified herein, to proper lengths.

.6 Where indicated on Drawings extend side rails to 1070 mm above landing level.

Part 3 Execution

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

3.2 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

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Part 1 General

1.1 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00 – Quality Control.

1.2 References

.1 National Building Code of Canada (NBC).

.2 Manitoba Building Code (MBC).

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R1998), Wire Nails, Spikes and Staples.

.2 CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-O141-91(R1999), Softwood Lumber.

.4 CSA O151-M1978 (R1998), Canadian Softwood Plywood.

.4 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2000.

1.3 Quality Assurance

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

1.4 Waste Management and Disposal

.1 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused wood materials from landfill to approved facility.

.4 Do not dispose of preservative treated wood through incineration.

.5 Do not dispose of preservative treated wood with materials destined for recycling or reuse.

.6 Dispose of treated wood, end pieces, wood scraps and sawdust at approved sanitary.

.7 Dispose of unused wood preservative material at official, approved hazardous material collections Site.

.8 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

Part 2 Products

2.1 Lumber Material

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips and fascia backing:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

2.2 Panel Materials

.1 Canadian softwood plywood (CSP): to CSA O151, standard construction.

2.3 Accessories

.1 Nails, spikes and staples: to CSA B111, hot dipped galvanized.

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.4 All interior fasteners to be type 304 stainless steel.

2.4 Wood Preservative

.1 Surface-applied wood preservative: copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

Part 3 Execution

3.1 Preparation

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum three (3) minute soak on lumber and one (1) minute soak on plywood.

.3 Retreat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as indicated and as follows:

.1 All wood in contact with unfinished concrete or masonry.

3.2 Installation

.1 Install furring and blocking as required to space-out and support fascia, soffit, siding and other Work as required.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.3 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other Work.

.4 Install fascia backing and nailers, and other wood supports as required and secure using galvanized steel fasteners.

.5 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 Erection

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other Work.

3.4 Schedules

.1 Provide electrical equipment backboards for mounting electrical and telecommunications/data equipment as indicated.

.2 Use 19 mm thick fire retardant treated plywood on 19 mm x 38 mm furring spaced at maximum 300 mm centres and at vertical edges of mounting board.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)
  .1 CAN/ULC-S705.1-01: Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification.
  .2 CAN/ULC-S705.2-05: Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

.2 CCMC 13467-R – Evaluation of BASF Walltite ECO as an air barrier system.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.
  .2 Submit two copies of WHMIS MSDS - Material Safety Data. Indicate VOC's insulation products and adhesives.

.2 Name of installer complete with proof that installer is licensed or approved by Canadian Urethane Foam Contractors Association (CUFCA), National Energy Conservation Association (NECA), as an insulation/air barrier system.

.3 Manufacturer's Instructions:
  .1 Submit manufacturer's installation instructions.
  .2 Submit manufacturer's printed product literature, specifications and datasheet and include:
    .1 Product characteristics.
      .1 Performance criteria.
      .2 Limitations.

1.3 TEST REPORTS

.1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification.

.2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

1.4 QUALITY ASSURANCE

.1 Personnel licensed or approved by CUFCA o NECA must apply the insulating material. These certified individuals must have their certification cards in their possession and available for presentation upon request. The certification cards must show the proper level of certification for the polyurethane foam application and air barrier system being performed as part of this Work; Level 1 (Basic), Level 2 (Superior), or Foam Masters (Elite Level) for the polyurethane foam application and air barrier system. A Foam Masters applicator is automatically approved for all.

.2 The system applicator shall include and pay all costs for testing of the installation, as required by the licensing/approval authority.

.3 A copy of the manufacturer’s technical manual for the application of spayed-on polyurethane foam must be kept on-site with the section for the air barrier system application guidelines.

1.5 SAFETY REQUIREMENTS

.1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
- .1 Workers must wear gloves respirators dust masks long sleeved clothing eye protection protective clothing when applying foam insulation.
- .2 Workers must not eat, drink or smoke while applying foam insulation.

1.6 PROTECTION

.1 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.2 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste foam daily in location designated by Contact Administrator or designate and decontaminate empty drums in accordance with foam manufacturer's instructions CAN/ULC-S705.2.

.2 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Reduction Workplan.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

PART 2 PRODUCTS

2.1 SPRAY-IN-PLACE POLYURETHANE FOAM INSULATION

.1 Polyurethane Foam: a spray applied polyurethane foam, closed cell, medium density, listed under CAN/ULC S705.1, with CCMC #13467-R for use as an insulation/air barrier system, according to CCMC technical guide: Air Barrier System for exterior walls of low-rise buildings, with the following physical properties:

- .1 Product: WALLTITE ECO by BASF.
- .2 Blowing Agent: product to utilize Zero Ozone Depleting Substance blowing agent.
- .3 Density (ASTM D-1622) minimum = 28.4 kg/m3 (1.77 lb/ft.3).
- .4 Compressive strength (ASTM D-1621), parallel to rise (10% compression) = 199 kPa (29 psi).
- .5 Tensile strength (ASTM D-1623) = 396 kPa (57 psi).
- .6 Open cell content (ASTM D-2856) = 4.56%.
- .7 Water absorption (ASTM D-2842) % by volume = 0.62%.
- .8 Dimensional stability (ASTM D-2126), % volume change after 28 days:
  - +20°C (-4°F) ambient humidity = 0.96%
  - +80°C (176°F) ambient humidity = 5.11%
  - +70°C (158°F) with relative humidity 97% = 8.60%.
- .9 Thermal resistance approved by CAN/ULC-S705.1.
- .10 Long Term Thermal Resistance CAN/ULC-S770:
  - RSI 0.93/25mm for thicknesses of 25mm to 50mm.
  - RSI 0.93/25mm for thicknesses of >50mm to 75mm.
  - RSI 0.97/25mm for thicknesses of >75mm to 100mm.
  - RSI 1.00/25mm for thicknesses of 100mm and greater.
- .11 Water vapour permeance (ASTM E-96) – without the skins, core only = 50 ng/Pa•s•m² @ 50mm (0.87 perm @ 2”).
- .12 Flame spread classification (CAN/ULC-S102, incl. S127) = <500.
- .13 Smoke development = <500.
- .14 Volatile Organic Compound (VOC) emissions during aging CAN/ULC S774 below detection limit after 24 hrs.

.2 Heatlok Soya as manufactured by Demilec Inc. may be approved equal, provided it meets the specified criteria. Submit manufacturer's product literature for review by Contract Administator. Product shall be in accordance with CCMC #12380-R for insulation, CCMC #12893-R for air barrier material, and in accordance with the technical guide requirements of CCMC #07272 for air-barrier system. Transition membranes, through-wall flashing, primers, sealants, and other related materials shall be of types as recommended by manufacturer.

.3 Foam-Lok as manufactured by Lapolla Canada may be approved equal, provided it meets the specified criteria. Submit manufacturer's product literature for review by Contract Adminisrator. Product shall be in accordance with CCMC #13414-L for insulation. Submit testing and approval information certifying use as an air-barrier material and system. Transition membranes, through-wall flashing, primers, sealants, and other related materials shall be of types as recommended by manufacturer.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

.1 Surfaces must be clean and dry, as required by CAN/ULC-S705.2-98. The substrate must be free of all frost, dust, oil, grease, oxidization, or any other element that may affect adhesion of the system i.e. high moisture content.

.2 Metallic surfaces should be checked to ensure no oxidization has occurred.

.3 All transition membranes must be installed prior to application of the polyurethane foam. These membranes must be installed in accordance with the manufacturer's recommendations. Adhesion of the membranes to the substrate must be sufficient to resist the stress applied by the polyurethane foam during the curing time.

.4 All of the following stages must be completed prior to application of the insulating / air barrier system:
- .1 Installation of masonry anchoring system.
- .2 Installation of wood blocking required at all openings.
- .3 Installation of any electrical or mechanical penetrations.
- .4 Adjacent areas have been protected via drop sheets or polyethylene masking.

3.2 APPLICATION

.1 Apply insulation to clean surfaces in accordance with CAN/ULC-S705.2 and manufacturer's printed instructions. Use primer where recommended by manufacturer.

.2 Apply sprayed foam insulation in thickness 89 mm., or to fill stud cavities at exterior walls completely.

.3 All excessively wide joints should be covered or filled before applying the polyurethane foam.

.4 Polyurethane foam when used for insulation purposes, should be sprayed as per the Standard CAN/ULC-S705.2 with a tolerance of +6 /-0 mm in relation to the specified thickness. When the intent of the spray polyurethane is for the insulation / air barrier system and the thickness specified is 25 mm then to respect the air barrier system tests results, the tolerance is +6/−0 mm.

.5 Avoid the formation of sub-layer air pockets when applying.

.6 Avoid spraying the foam on any surfaces other than those indicated. Use drop sheets or masking tape to protect other surfaces.

.7 Once the foam has hardened, remove all overspray from non-prescribed surfaces.

.8 Do not allow polyurethane foam once applied, to be damaged during work by other trades.

.9 Ensure the subsequent coverage of the applied insulating foam will be completed within the manufacturer’s prescribed time frame.

.10 Spray the polyurethane foam in overlapping layers, so as to obtain a smooth, uniform surface.

.11 Do not spray polyurethane foam any closer than 75 mm from chimneys, heating vents, steam pipes, recessed lighting fixtures, and other heat sources. Do not spray the interior of any exit openings or electrical junction boxes.

.12 All mechanical fixtures should be covered with polyurethane foam in order to reduce thermal bridging.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 The scope of this section generally includes but not limited to:
- .1 Underlayment.
- .2 Roof panel clip system.
- .3 Roof panel.
- .4 Accessories including associated flashings, closures, sealants.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 National Building Code of Canada (NBC).

.2 Manitoba Building Code (MBC).

.3 Design of cladding system in accordance to the latest edition of:
- .1 CSA-S136 for the design of Cold Formed Steel Structural Members.
- .2 Canadian Sheet Steel Building Institute Standards 10M and 20M.
- .3 National Building Code of Canada.

.4 The Aluminum Association Inc. (AA)
- .1 Aluminum Sheet Metal Work in Building Construction-2000.
- .2 AA DAF45-97, Designation System for Aluminum Finishes.

.5 American Society for Testing and Materials (ASTM International)
- .1 ASTM A606-01, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- .2 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM A792/A792M-02, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .4 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
- .5 ASTM D822-01, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.6 Canadian Roofing Contractors Association (CRCA)
- .1 Roofing Specifications Manual 1997.

.7 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-19.13-M87, sealing compound, one component, silicone base, chemical curing.

.2 CAN/CGSB-19.24-M90, sealing compound, multi-component, chemical curing.
.3 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
.4 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
.5 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.8 Canadian Standards Association (CSA International)
.1 CSA A123.3-98, Asphalt Saturated Organic Roofing Felt.
.2 CSA B111-1974(R1998), Wire Nails, Spikes and Staples.

1.3 DESIGN REQUIREMENTS

.1 Design roof system to resist:
.1 Snow loads and snow build-up and rain load, expected in this geographical region NBCC climatic data, 50 year probability.
.2 Wind loads, positive and negative, expected in this geographical region NBCC climatic data, 50 year probability.
.3 Dead load of roof system.

.2 Deflection of the roof system is not to exceed $1/180^{th}$ of the span for the specified live loading.

.3 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, overstressing of components, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
.1 Temperature Change (Range): 20 deg C, ambient; 40 deg C, material surfaces

1.4 SAMPLES

.1 Submit samples of standard coloured metal roof for review by the Contract Administrator, prior to fabrication.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 23.
.1 Indicate arrangement of pre-finished Roof Sheet, including joints, types and locations of supports, fasteners, flashing, gutters, mitres, and all metal components related to the roof installation. Include for underlayment as part of the roof system.
.2 Drawings shall be signed and sealed by a professional Engineer, licensed to practice in the province of Manitoba to attest to the ability of the metal panels assembly to withstand the specified loads.

1.6 PRODUCT DELIVERY, HANDLING AND STORAGE

.1 Store components and materials in accordance with panel manufacturer's recommendations and protect from elements.

.2 Protect prefinished steel during fabrication, transportation, Site storage and erection, in accordance with CSSBI Standards.

1.7 GUARANTEE

.1 For the Work in this section, warranty by installer against defects or deficiencies in materials or workmanship shall be for a period of one year from date of substantial completion.

Part 2 Products

2.1 ROOF SYSTEM COMPONENTS

.1 Roof System: Tradition100-4 on Solid Substrate by Vicwest.
- .1 Underlayment: Membrane shall be Ice and Water Shield by W.R. Grace or an approved equal.

.2 Clip System
- .1 Thermally responsive clips to be fabricated from a minimum of 0.91 mm (.036") steel, with minimum Z275 galvanized coating designed to accommodate expansion and contraction of the roof sheet.
- .2 Roof Fasteners: As specified by manufacturer, to resist wind uplift and sliding snow forces.

.3 Prefinished Roof Sheet, exposed to exterior.
- .1 Profile: Tradition 100-4, with I-style ribs at 400 mm spacing.
- .2 Panel: Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 having a nominal core thickness 0.76 mm (0.030").

.4 Snap Cap
- .1 Provide 25 mm high snap caps for full length of the roof panel and retained by panel clips, fabricated from Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653M structural quality Grade 230 having a minimum nominal core thickness 0.61mm (0.024"). Finish and colour to match roof sheet.

2.2 PANEL FINISHES

.1 Coating: Prepainted with WeatherX™ on interior face

2.3 COLOUR

.1 Colour to be selected from the manufacturer’s standard colour range.

2.4 ACCESSORIES

.1 Flashing: Formed from same materials as the roof sheet. Custom fabricated to suit architectural details, as required.

.2 Closures: Foam and metal closures to suit profiles selected, to manufacturer's recommendations.

.3 Fascia: brake formed to profile indicated on Drawings matching roof sheet material.

.4 Soffit: perforated and prefinished sections in colour to match fascia and roofing complete with wall trim.

.5 Sealants: In accordance with manufacturer's recommendation and Section 07 92 00.

2.5 FABRICATION

.1 Fabricate roof components to comply with dimensions, profiles, gauges and details as shown on the shop drawings, including fascia and soffit panels and all companion flashing.

.2 Fabricate all components of the system in the factory, ready for field installation.

.3 Provide roof sheet and all accessories in longest practicable length to minimize field lapping of joints.

Part 3 Execution

3.1 EXAMINATION

.1 Examine Work of other Sections upon which Work of this Section depends.

.2 Report all discrepancies to Contract Administrator before beginning Work on the roof system.

3.2 INSTALLATION

.1 Roof Materials:
- .1 Underlayment: Install underlayment fully adhered to solid substrate according to manufacturer's recommendations. Ensure all joints are properly lapped and sealed. Tie in with barriers on adjacent surfaces to ensure airtight construction. Provide a continuous seal around all openings in the insulated metal roof system.
- .2 Clip: Attach Tradition clips using fasteners as recommended by the manufacturer, to suit the substrate.

.2 Roof Panel Installation
- .1 Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure. Ensure metal roofing sheet side-lap is positively retained by clips, and proper sheet coverage is maintained.
- .2 Install the snap-cap at all side laps as shown on the approved shop drawings. Mitre snap-cap as required to resist water entry.
- .3 Where indicated on approved shop drawings, secure the end-lap of metal roofing sheets in accordance with the manufacturers specifications and details to provide a weather-tight seal. Exposed fasteners to match colour of the roof sheet.
- .4 Provide notched and formed closures, sealed against weather penetration, at changes in pitch, and at ridges and eaves, where required.
- .5 Install all companion flashings, fascia, soffits as shown on the shop drawings.
- .6 Use concealed fasteners when possible. Exposed fasteners to match colour of roof sheet.

.3 CLEAN-UP

.1 Clean exposed panel surfaces in accordance with manufacturer’s instructions.

.2 Repair and touch up with colour matching high grade enamel minor surface damage, only where permitted by the Contract Administrator and only where appearance after touch-up is acceptable to Contract Administrator.

.3 Replace damaged panels and components that, in opinion of the Contract Administrator, cannot be satisfactorily repaired.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Shop Drawings and Submittals.

.2 Section 01 45 00 – Quality Control.

.3 Section 08 11 14 – Metal Doors and Frames.

1.3 REFERENCES

.1 National Building Code of Canada (NBC).

.2 Manitoba Building Code (MBC).

.3 American Society for Testing and Materials International, (ASTM)

.1 ASTM C919-02, Standard Practice for Use of Sealants in Acoustical Applications.

.4 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No.1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB-19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound, Type 2, Class B.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Shop Drawings and Submittals.

.2 Manufacturer's product to describe.

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit samples in accordance with Section 01 33 00 - Shop Drawings and Submittals.

.4 Submit duplicate samples of each type of material and colour.

.5 Cured samples of exposed sealants for each color where required to match adjacent material.

.6 Submit manufacturer's instructions in accordance with Section 01 33 00 – Shop Drawings and Submittals.

.7 Instructions to include installation instructions for each product used.

1.5 QUALITY ASSURANCE

.1 Carry out the supply and installation of sealants and caulking work by recognized Specialist Applicators having at least five (5) years of proven satisfactory experience and having skilled workmen thoroughly trained and competent in all phases of caulking Work.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

.3 Store materials in dry location in such manner that no damage will be done to materials or building.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.5 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.6 Divert unused joint sealing material from landfill to an approved, official hazardous material collections site.

.7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.8 Fold up metal banding, flatten, and place in designated area for recycling.

1.8 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

1.10 WARRANTY

.1 Provide written warranty covering the Work of this Section for a period of two years from the date of Substantial Completion as per the Project Agreement.

.2 Defective Work shall include but not be restricted to leakage, cracking, crumbling, melting, running, loss of adhesion, loss of cohesion, staining of adjoining or adjacent surfaces or Work.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off-gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Sealants - Type A

.1 Multi-component sealants to meet CGSB Specification CAN/CGSB-19.24, (2-part urethane) or single component sealant to meet CGSB Specification CAN/CGSB-19.13, (silicone) to be used for:

.1 Exterior joints around perimeters of metal door frames including thresholds and sills.

.2 Exterior joints around perimeters of louvre frames and duct penetrations.

.3 Exterior perimeter of conduit, wire and pipe penetrations.

.4 Exterior control joints.

.5 Roof flashings.

.2 Use one of the following sealants:

.1 Dymeric by Tremco (Canada) Limited.

.2 1200 Sealant by CGE Canada Ltd.

.3 795 Sealant by Dow Corning Canada.

.2 Sealants - Type B

.1 Acrylic solvent release, one part sealant, to meet CGSB Specification 19-GP-5M, to be used for all other locations where caulking beads remain exposed:

.1 Interior perimeters of door and window frames, louvre openings, service penetrations and ducts.

.2 Interior movement joints in exterior masonry walls

.3 Use one of the following sealants:

.1 Mono by Tremco (Canada) Limited.

.2 Acryflex by Sternson Ltd.

.3 Parr-Crylic by Parr Sealants of Canada Ltd.

.4 PR12-100 Vinyl Acrylic by PRC Canada Ltd.

.4 Silicone Sealant – Type C

.1 Apply clear, mildew resistant silicone sealant at perimeter of backsplashes, at millwork mounted against walls, at washroom vanities, and around plumbing fixtures at floor and wall surfaces.

.2 Use one of the following sealants:

.1 Tremsil 200 by Tremco (Canada) Ltd.

.2 DAP 3.0

.5 Primers

.1 To be of a type recommended by sealant manufacturer for the appropriate sealant and corresponding substrate.

.6 Preformed Compressible and Non-Compressible back-up materials.

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open closed cell foam backer rod.

.2 Size: oversize 30 to 50%.

.2 Neoprene or Butyl Rubber.

.1 Round solid rod, Shore A hardness 70.

.3 High Density Foam.

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond Breaker Tape.

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 COLOURS

.1 Colours of sealant, shall match the predominant material to which sealant is applied.

2.4 JOINT CLEANER

.1 Non-corrosive and non-taining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant.

- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as Work progresses and upon completion.

.2 Curing.

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

.3 Clean-up.

- .1 Clean adjacent surfaces immediately and leave Work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as Work progresses.
- .3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 07 92 10 – Joint Sealing: Caulking of joints between frames and other building components.

.3 Section 08 71 10 – Door Hardware: Supply of finish hardware, including weatherstripping and mounting heights.

.4 Section 09 91 00 – Painting and Protective Coatings.

1.2 REFERENCES

.1 National Building Code of Canada (NBC).

.2 Manitoba Building Code (MBC).

.3 American Society for Testing and Materials (ASTM International)

.1 ASTM A653/A653M-03, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.ASTM B29-92 (1997), Specification for Refined LeadASTM B749-97, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors

.5 Canadian Standards Association (CSA International)

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

.2 CSA W59-M1989 (R2001), Welded Steel Construction (Metal Arc Welding) (Metric Version).

.6 Canadian Steel Door Manufacturers' Association, (CSDMA)

.1 CSDMA, Specifications for Commercial Steel Doors and Frames, 1990.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.

.7 National Fire Protection Association (NFPA)

.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.NFPA 252-99, Standard Methods of Fire Tests of Door Assemblies.

.8 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104-M80, Fire Tests of Door Assemblies.

.2 CAN4-S105-M85, Fire Door Frames Meeting the Performance Required by CAN4-S104.

.3 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.4 CAN/ULC-S702-97, Mineral Fibre Thermal Insulation for Buildings.

.5 CAN/ULC-S704-03, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing firerating finishes.

.4 Indicate details of construction and installation of all components of the work.

.5 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.6 Submit test and engineering data, and installation instructions.

1.5 REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M, CAN4-S105M and NFPA 252 for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104, ASTM E152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 WARRANTY

.1 Materials and workmanship shall be warranted by manufacturer in accordance with Canadian Steel Door Manufacturers' Association, (CSDMA) Standard Warranty for Steel Doors and Frames.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

.3 Divert unused paint and sealant materials from landfill to an approved, official hazardous material collections site.

.4 Do not dispose of unused paint and sealant materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

.5 Divert unused metal materials from landfill to an approved metal recycling facility.

.6 Divert unused wood materials from landfill to an approved recycling facility.

.7 Damaged or broken glazing materials are not recyclable. These materials must not be disposed of with materials destined for recycling.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Only steel frame products manufactured by Canadian Steel Door Manufacturers' Association, (CSDMA) members are eligible for use on this project.

2.2 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, hot dipped galvanized .

2.3 DOOR CORE MATERIALS

.1 Insulated:

.1 Expanded polystyrene: CAN/ULC-S701, density 16 to 32 kg/m^3.

2.4 ADHESIVES

.1 Polystyrene cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.5 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

2.6 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 00 – Painting and Protective Coatings. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

2.7 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma steel.

.3 Door bottom seal: to Section 08 71 10 - Door Hardware.

.4 Metallic paste filler: to manufacturer's standard.

.5 Accessories (doors and frames) and minimum base steel thickness:

.1	Lock/strike reinforcements:	1.6 mm
.2	Hinge reinforcements:	2.7 mm
.3	Flush bolt reinforcements:	1.6 mm
.4	Reinforcements for surface applied hardware:	1.2 mm
.5	Top or bottom channels:	1.2 mm
.6	Glass trim, screw fixed or snap-in types:	0.9 mm
.7	Mortar guard boxes:	0.8 mm
.8	Floor anchors:	1.6 mm
.9	Jamb spreaders:	0.9 mm

.6 Sealant: to Section 07 92 10 - Joint Sealing.

2.8 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications, reviewed Shop Drawings and listing requirements.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Finish: hot dipped galvanized after fabrication.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, andelectronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cutouts with steel guard boxes welded to frame.

.6 Prepare frame for door silencers, three (3) for single door, and two (2) at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Incorporate thermal break and insulate exterior frame components with mineral wool insulation.

2.9 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb, minimum three (3) anchors per jamb.

.3 Provide two (2) anchors for rebate opening heights up to 1520 mm and one (1) additional anchor for each additional 760 mm of height or fraction thereof.

2.10 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane; fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Incorporate non thermally conductive thermal break within frame assembly.

2.11 DOOR FABRICATION GENERAL

.1 Fabricate doors in accordance with CSDMA specifications, reviewed Shop Drawings and listing requirements.

.2 Doors: swing type, flush, with provision for single, sealed insulated glass units, and louvre openings as indicated.

.3 Interior doors: honeycomb hollow steel construction

.4 Exterior doors: insulated polystyrene core construction

.5 Fabricate doors with longitudinal edges mechanically interlocked with visible seams.

.6 Bevel hinge and lock edges of doors, 3 mm in 50 mm.

.7 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.8 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on-site, at time of hardware installation.

.9 Reinforce doors where required, for surface mounted hardware.

.10 Provide flush PVC steel top caps to exterior doors.

.11 Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.12 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.13 Provide 127 mm backset for all locksets and latchsets where indicated in the Door Schedule.

2.12 HOLLOW STEEL CONSTRUCTION (WITH INTERNAL STEEL REINFORCING)

.1 Form each face sheet for exterior doors from 1.6 mm (16 gauge) galvanized sheet steel with polystyrene core laminated under pressure to face sheets.

.2 Form each face sheet for interior doors from 1.3 mm (18 gauge) galvanized sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

.4 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.

2.13 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Welding of thermally broken frames must not cause thermal transfers between exterior and interior surfaces of frame sections.

.5 Fill voids in frame with mineral wool insulation prior to insulation.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

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

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

.7 Install door silencers after finish painting of frame has been completed.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 10 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.
.2 Latchside and head: 1.5 mm.
.3 Finished floor and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

.5 Install vinyl top caps in out swinging exterior doors for weather protection.

3.4 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 08 11 14 - Metal Doors and Frames.

1.2 REFERENCES

.1 National Building Code of Canada (NBC).

.2 Manitoba Building Code (MBC).

.3 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.4 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-69.17-M86 (R1993), Bored and Preassembled Locks and Latches.

.2 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.

.3 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1984, Exit Devices.

.4 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

.5 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.

.6 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.

.7 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.

.8 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

.9 CAN/CGSB-69.31-M89/ANSI/BHMA A156.15-1981, Closer/Holder Release Device.

.10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

.11 CAN/CGSB-69.34-93/ANSI/BHMA A156.18-1987, Materials and Finishes.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:

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

.2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.3 After approval samples will be returned for incorporation in the Work.

.3 Hardware List:

.1 Submit Contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.5 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 Storage and Protection:

.1 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

.1 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply two sets of wrenches for door closers, locksets and exit hardware.

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Butts and hinges: to CAN/CGSB-69.18, (3 per door for doors up to 2135 and 4 per door for doors up to 2440 in height or over 914 in width), NRP, ball bearing type, stainless steel.

.1 Acceptable products:

.1 Hagar AB850 x 114 x 114

.2 Stanley CB199 x 114 x 114

.3 Contract Administrator approved equal.

.2 Exit devices: to CAN/CGSB-69.19, rim exit device, ULC rated, with cylinder core, exterior lever handle trim and vinyl touch bar.

.1 Acceptable products:

.1 Von Duprin 98 series

.2 Sargent 8800 series

.3 Contract Administrator approved equal.

.2 Locksets:

.1 Locksets to CAN/CGSB-69.17 –M86, Grade 1 lever handle, bored locksets.

.2 Provide construction cylinder cores and final cores with keying to City's Medeco master key system.

.3 Acceptable products for interior locksets:

.1 Medeco.

.4 Acceptable products for exterior locksets:

.1 Medeco.

.3 Door Closers and Accessories:

.1 Door controls (closers): to CAN/CGSB-69.20, one per door. All door closers shall be through bolted. Finish aluminum lacquer.

.1 Acceptable products:

.1 LCN 4040 Super Smoothee by LCN closers

.2 Door controls - overhead holders: to CAN/CGSB-69.24, extruded bronze, 110 degree hold-open and stop, one per door.

.1 Acceptable products:

.1 Sargent 598H

.4 Architectural door trim: to CAN/CGSB-69.22, as listed below.

.1 Door protection plates: kick plate type, 1.27 mm thick stainless steel.

.1 Acceptable products:

.1 Canadian Builders Hardware

.5 Thresholds: 150 mm, extruded aluminum with thermal break.

.1 Acceptable products:

.1 K. N. Crowder CT-46.

.6 Weatherstripping:

.1 Head and jamb seal: Adjustable spring loaded, vinyl in extruded aluminum trim

.1 Acceptable products:

.1 K. N. Crowder W44.

.2 Door bottom seal: Neoprene rubber in extruded aluminum trim

.1 Acceptable products:

.1 K. N. Crowder Type CT-54 Automatic door bottom.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

.6 All fasteners to be non-corroding.

2.4 KEYING

.1 Lay out keying system in consultation with the City. Keying system shall include keying alike, keying differently, keying in groups, submaster keying and grand master keying locks as necessary to meet the requirements of the City.

.2 Keying chart and related explanatory data shall be prepared and submitted to the City for approval, and lock work shall not be commenced until written confirmation of keying arrangements is received from the City.

.3 Provide keys in duplicate for every lock.

.4 Stamp keying code numbers on keys and cylinders.

.5 Provide cabinet for key control with two tag security system complete with key loan register, three-way cross reference index, and cabinet door locking device.

.6 All locks shall be operated by a construction master key in construction cylinder cores while the building is under construction, but shall not operate when the temporary construction cores are replaced with permanent master keyed cylinders at completion of the building.

.7 Provide all permanent cores and keys to City.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their Work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.4 Remove construction cores when directed by Engineer; install permanent cores and check operation of locks.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer’s instructions.

.3 Remove protective material from hardware items where present.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Moisture testing of substrates.

.2 Surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to limits defined under MPI Repainting Maintenance Manual requirements.

.3 Specific pre-treatments noted herein or specified in the MPI Repainting Maintenance Manual.

.4 Sealing/touch-up, spot priming, and/or full priming surfaces for repainting in accordance with MPI Repainting Maintenance Manual requirements.

.5 Provision of safe and adequate ventilation as required where toxic and/or volatile/flammable materials are being used over and above temporary ventilation supplied by others.

1.2 REFERENCES

.1 Maintenance Repainting Manual by the Master Painters Institute (MPI), including Identifiers, Evaluation, Systems, Preparation and Approved Product List.

.2 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.3 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five (5) years proven satisfactory experience. Provide a list of last three (3) comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they Work under the direct supervision of a qualified journeyman in accordance with applicable trade regulations.

.3 Conform to latest MPI requirements for interior painting work including cleaning, preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the latest edition of the MPI Approved Product List and shall be from a single manufacturer for each system used.

.5 Paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Maintenance

Repainting Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.

.7 Standard of Acceptance: When viewed using final lighting source surfaces shall indicate the following:
- .1 Walls: No defects visible from a distance of 1000 mm at 90^{o} to surface.
- .2 Ceilings: No defects visible from floor at 45^{o} to surface.
- .3 Final coat to exhibit uniformity of colour and sheen across full surface area.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide indoor paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

1.5 INSPECTION REQUIREMENTS

.1 Interior surfaces requiring repainting shall be inspected by both painting contractor who will notify Contract Administrator and Contractor in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.2 Where an assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered shall be rectified by others, as mutually agreed, before repainting is started.

1.6 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with the requirements of Section 01 30 00 – Submittal Procedures.

.2 Submit full range colour sample chips for review and selection. Indicate where colour availability is restricted.

.3 Submit WHMIS MSDS - Material Safety Data Sheets for paint and coating materials in accordance with Section.

.4 Upon completion, submit records of products used. List products in relation to finish system and include the following:
- .1 Product name, type and use (i.e., materials and location).
- .2 Manufacturer's product number.
- .3 Colour code numbers.
- .4 MPI Environmentally Friendly classification system rating.
- .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.7 QUALITY CONTROL

.1 Provide a mock-up in accordance with requirements of Section 01 33 00.

.2 Prepare and repaint mock-up designated interior room, surface or item to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Maintenance Repainting Manual standards for review and approval.

.3 When approved, repainted room, surface and/or item shall become acceptable standard of finish quality and workmanship for similar on-site interior repainting work.

1.8 DELIVERY, HANDLING AND STORAGE

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Labels shall clearly indicate:
- .1 Manufacturer's name and address.
- .2 Type of paint or coating.
- .3 Compliance with applicable standard.
- .4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from Site.

.4 Observe manufacturer's recommendations for storage and handling.

.5 Store materials and equipment in a secure, dry, well-ventilated area with temperature range between 7°C to 30°C. Store materials and supplies away from heat generating devices and sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Contract Administrator. After completion of operations, return areas to clean condition to approval of Contract Administrator.

.7 Remove paint materials from storage in quantities required for same day use.

.8 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.9 Fire Safety Requirements:
- .1 Provide one (1) 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
- .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from Site on a daily basis.
- .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:
- .1 Perform no repainting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application and until paint has cured sufficiently.

.2 Ventilate enclosed spaces. Where required, provide continuous ventilation for seven (7) days after completion of application of paint.

.3 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements. The use of gas-fired appliances is not permitted.

.4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no repainting work when:

.1 Ambient air and substrate temperatures are below 10°C.

.2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.

.3 Relative humidity within area to be repainted is above 85%.

.2 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except use a simple "cover patch test" on concrete floors to be repainted.

.3 Perform no repainting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.4 Test painted concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured, unless otherwise pre-approved by the specific coating manufacturer.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.2 Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
- .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
- .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
- .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
- .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
- .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.5 Where paint recycling is available, collect waste materials by type and provide for delivery to recycling or collection facility.

.6 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

1.11 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Special Provisions of the Contract.

.2 Submit one (1), 4 L can of each type and colour of finish coating. Identify type and colour in relation to established colour schedule and finish system.

.3 Deliver to City and store where directed.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the latest edition of the MPI Approved Product List (APL) as supplied by one of following manufacturers are acceptable for use on this project:
- .1 ICI Devoe.
- .2 Pittsburgh Paints.
- .3 Colour Your World.
- .4 Pratt and Lambert.
- .5 Benjamin Moore.
- .6 Para Paints.

.2 Where required by authorities having jurisdiction, paints and coatings shall provide a fire resistant rating.

.3 Paint materials for repaint systems shall be products of a single manufacturer.

.4 Paints and coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Paints and coatings must not be formulated or manufactured with formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

2.2 COLOURS

.1 Contract Administrator will provide Colour Schedule after Contract award.

.2 Colour schedule will be based upon selection of five (5) base colours and three (3) accent colours. No more than eight (8) colours will be selected for the entire project and no more than three (3) colours will be selected in each area.

.3 Selection of colours will be from manufacturer’s full range of colours.

.4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.5 First coat in a two coat (Premium) repaint system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to Site.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI gloss / sheen standard values:

GLOSS LEVEL CATEGORY	UNITS @ 60^{O}	UNITS @ 85^{O}
G1 - matte finish	0 to 5	maximum 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	minimum 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of repainted surfaces shall be as specified herein and as noted on Finish Schedule.**INTERIOR PAINTING SYSTEMS**

.1 Applies to new finishes over previously unpainted surfaces or new shop primed surfaces to be field painted.

.2 Refer to Finish Schedule on architectural drawings for locations.

.3 Galvanized and non-galvanized metal: doors, frames, railings, structural and miscellaneous metals (within floor to underside of ceilings)
- .1 Alkyd primer/sealer – One (1) coat.
- .2 Alkyd - G5 finish – Two (2) coats.

.4 Gypsum board and exposed plywood: gypsum wallboard, drywall, "sheet rock type material", plywood and wood:
- .1 Latex primer/sealer – One (1) coat.
- .2 Latex G3 finish – Two (2) coats.

.5 Canvas and cotton coverings.
- .1 Latex G1 finish – Two (2) coats.

2.6 INTERIOR RE-PAINTING SYSTEMS

.1 Applies to previously painted surfaces, not new or shop primed.

.2 Galvanized and non galvanized metal: doors, frames, railings, misc. steel, pipes, , and ducts.
- .1 Prepare by mechanical means or shot blasting
- .2 Alkyd primer – 1 Alkyd - G5 – Two (2) coats.

.3 Concrete and masonry surfaces:
- .1 Latex block filler – One (1) thick coat to fill pores.
- .2 Latex G3 finish – Two (2) coats.

.4 Canvas and cotton coverings.
- .1 Latex G1 finish – Two (2) coats.

2.7 EXTERIOR PAINTING AND RE-PAINTING SYSTEMS

.1 Galvanized Metal:
- .1 Galv, metal primer – One (1) coat.
- .2 Alkyd G5 level finish – Two (2) coats.

2.8 ANTI-GRAFFITI COATING:

.1 Applied to exterior masonry and exposed concrete surfaces:
- .1 Sherwin Williams Anti-Graffiti Coating (or Contract Administrator approved alternate) siloxane, non-stick transparent coating with non-glossy finish applied following suppliers instructions on sand blasted and clean surfaces.

PART 3 EXECUTION

3.1 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Maintenance Repainting Manual requirements except where otherwise specified.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

.1 Prior to commencing Work, thoroughly examine Site conditions and existing interior substrates to be repainted. Report in writing to Contract Administrator damages, defects, or unsatisfactory or unfavourable conditions or surfaces that will adversely affect this work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Contract Administrator. Maximum moisture content shall not exceed limits specified herein.

.3 No repainting work shall commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency. Commencement of Work shall not be held to imply acceptance of surfaces except as qualified herein.

.4 Degree of surface deterioration (DSD) shall be assessed using MPI Identifiers and Assessment criteria indicated in the MPI Maintenance Repainting Manual. MPI DSD ratings and descriptions are as follows:

CONDITION	DESCRIPTION
DSD-0	Sound Surface (includes visual (aesthetic) defects that do not affect film's protective properties).
DSD-1	Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes scratches, etc.).
DSD-2	Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, staining, etc.).
DSD-3	Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
DSD-4	Substrate Damage (repair or replacement of surface required by others).

3.3 PROTECTION

.1 Protect existing surfaces and adjacent fixtures and furnishings from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Contract Administrator.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect general public and building occupants in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and surface mounted equipment, fittings and fastenings shall be done prior to undertaking re-painting operations by Contractor. Items shall be securely stored and re-installed by Contractor after painting is completed.

.6 Move and cover furniture and portable equipment as necessary to carry out repainting operations. Replace as painting operations progress.

.7 As repainting operations progress, place "WET PAINT" signs in occupied areas to approval of Contract Administrator.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare interior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

- .1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
- .2 Remove chipped, loose, scaling, sealants and caulking materials, fasteners, adhesive residues etc. or other surface blemishes which would impair the final results.
- .3 Patch small holes and depressions in drywall finishes with appropriate patching compound and sand flush with adjacent finish.

.4 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and surface contaminants.
.5 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
.6 Allow surfaces to drain completely and to dry thoroughly. Allow sufficient drying time and test surfaces using an electronic moisture meter before commencing work.
.7 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
.8 Many water-based paints cannot be removed with water once dried. Minimize the use of kerosene or such organic solvents to clean up water-based paints.

.2 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.4 Do not apply paint until prepared surfaces have been accepted by Contract Administrator.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.5 APPLICATION

.1 Apply paint by method that is best suited for substrate being repainted using brush roller air sprayer and/or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise. Methods of application shall be as pre-approved by Contract Administrator before commencing the work.

.2 Brush and Roller Application:
.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
.2 Work paint into cracks, crevices and corners.
.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.
.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application by continuous mechanical agitation intermittent agitation frequently as necessary.
- .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .4 Back roll spray applications and brush out runs and sags immediately.
- .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Contract Administrator.

.5 Apply paint coats in a continuous manner and allow surfaces to dry and properly cure between coats for minimum time period as recommended by manufacturer. Minimum dry film thickness of coats shall not be less than that recommended by the manufacturer. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Sand and dust between coats to remove visible defects.

.7 Repaint surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.8 Repaint top, bottom, and vertical edges of doors to be repainted.

.9 Repaint closets and alcoves to match existing, unless otherwise scheduled or noted.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise noted, repainting shall also include exposed to view/previously painted mechanical and electrical equipment and components (panels, conduits, piping, hangers, ductwork, ventilation fan enclosures, etc.).

.2 Touch up scratches and marks and repaint such mechanical and electrical equipment and components with colour, and sheen finish to match existing unless otherwise noted or scheduled.

.3 Do not paint over name plates or instruction labels.

.4 Leave unfinished exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish.

.5 Keep sprinkler heads free of paint.

.6 Do not paint interior transformers and substation equipment.

3.7 CLEAN-UP

.1 Remove 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 same in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction and as noted herein.

.5 Painting equipment shall be cleaned in leak-proof containers that will permit particulate matter to settle out and be collected. Sediment remaining from cleaning operations shall be recycled or disposed of in a manner acceptable to authorities having jurisdiction.

.6 Paint and coatings in excess of repainting requirements shall be recycled as noted herein.

3.8 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on affected exposed surfaces. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Contract Administrator. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
- .4 Maintenance data to include: servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .1 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One (1) set of packing for each pump.

.2 One (1) casing joint gasket for each size pump.

.3 One (1) glass for each gauge glass.

.4 One (1) filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one (1) set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PAINTING, REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 00 - Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic Site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule Site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

.1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

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

.1 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.2 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.3 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.4 ASTM C533, Calcium Silicate Block and Pipe Thermal Insulation.

.5 ASTM C547, Mineral Fiber Pipe Insulation.

.6 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.7 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.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 Manufacturer's Trade Associations

.1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.

.5 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings

.4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC:

.1 CRF: Code Rectangular Finish.

.2 CPF: Code Piping Finish.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit Project requirements.

.1 Insulation: to ASTM C533.
.2 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: compatible with insulation.

.2 Stainless steel:

.1 Type: 304.
.2 Thickness: 0.25 mm.
.3 Finish: smooth.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.8 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 10 - Joint Sealing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturer’s instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: C-2 with vapour retarder jacket.

.1 Seals: lap seal adhesive, lagging adhesive.

.2 Installation: TIAC Code: 1501-C.

.3 TIAC Code: A-2.

.1 Seals: lap seal adhesive, lagging adhesive.

.2 Installation: TIAC Code: 1501-H.

.4 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp°C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
• Domestic CWS with vapour retarder		C-2	25	25	25	25	25	25
• Diesel generator exhaust system		A-2	38	65	65	75	90	90

.5 Finishes:

.1 Exposed indoors: canvas.

.2 Concealed, indoors: canvas on valves, fittings. No further finish.

.3 Outdoors: water-proof SS jacket.

.4 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.

.5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for copper domestic water service used in the following:

.1 Hard drawn copper domestic cold water services inside building.

.2 Soft copper buried tubing outside building, as in between potable water source and meter inside building.

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.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.3 American Water Works Association (AWWA).

.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.

.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.6 National Research Council (NRC)/Institute for Research in Construction.

.1 National Plumbing Code of Canada [complete with Manitoba Amendments (MPC)].

1.3 SUBMITTALS

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

.2 Submit product data for following: valves.

.3 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, Type L: to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, Type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: roll grooved to CSA B242.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 GLOBE VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

2.5 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

2.6 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and Buna N seat, steel lever handle.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and Buna N seat, steel lever handle, with NPT to copper adaptors.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with MPC and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install CWS piping below and away from heat sources so as to maintain temperature of cold water.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.5 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results - Mechanical.

.2 Test pressure: greater of 1.5 times maximum system operating pressure or 860 kPa.

3.4 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.5 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Certificate of static completion has been issued.

.2 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Rectify start-up deficiencies.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 The installation of drainage waste and vent piping.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM B32, Specification for Solder Metal.
.2 ASTM B306, Specification for Copper Drainage Tube (DWV).
.3 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).

.1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
.2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
.3 CAN/CSA-B125, Plumbing Fittings.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary and vent Type DWV to: ASTM B306.

.1 Fittings.
.1 Cast brass: to CAN/CSA-B125.
.2 Wrought copper: to CAN/CSA-B125.
.2 Solder: lead free, tin-95:5, type TA, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground sanitary and vent: to CAN/CSA-B70.

.1 Joints.
.1 Hub and spigot.
.1 Caulking lead: to CSA B67.
.2 Mechanical joints.
.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for piping, fittings, equipment used in compressed air systems.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.

.1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.

.2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.

.3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.

.2 ASME B16.5, Pipe Flanges and Flanged Fittings.

.3 ASME B16.11, Forged Fittings, Socket-Welding and Threaded.

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

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

.2 ASTM A181/A181M, Standard Specification for Carbon Steel Forgings for General Purpose Piping.

.3 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

.3 Shop Drawings:

.1 Submit shop drawings to indicate Project layout including layout, dimensions and extent of piping system.

.1 Vertical and horizontal piping locations and elevations and connections details.

.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with

specifications for specified performance characteristics and physical properties.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 AIR COMPRESSOR

.1 Refer to Drawing M-1.

2.2 COMBINATION FILTER-REGULATOR

.1 Factory assembled, heavy-duty with mounting bracket and low pressure side relief valve.

.2 Maximum inlet pressure: 1000 kPa.

.3 Operating temperature: -18°C to 52°C.

.4 Filter element: 40 micron. Bowls: polycarbonate.

.5 Pressure range in regulator: 34 kPa to 1000 kPa.

.6 Gauge range: 0 kPa to 1100 kPa.

2.3 BALL VALVES

.1 One piece design, stainless steel body.

.2 To withstand 1034 kPa maximum pressure.

.3 Standard of Acceptance: Swagelok 40 Series.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 COMPRESSED AIR LINE FILTER

.1 Install on discharge line.

□

3.3 MAIN AIR PRESSURE REGULATORS

.1 Install as indicated.

3.4 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION

.1 Install flexible connection where required.

.2 Install shut-off valves at outlets, major branch lines and in locations as indicated.

.3 Install quick-coupler chucks and pressure gauges on drop pipes.

.4 Install unions to permit removal or replacement of equipment.

.5 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.

.6 Make branch connections from top of main.

3.5 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Testing: pressure test in accordance with requirements of Section 21 05 01 - Common Work Results - Mechanical, for four (4) hours minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.

3.6 CLEANING

.1 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.

.2 AWWA C701, Cold Water Meters-Turbine Type for Customer Service.

.3 AWWA C702-1, Cold Water Meters-Compound Type.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.2 CSA-B79, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.

.3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Plumbing and Drainage Institute (PDI).

.1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

.2 PDI-WH201, Water Hammer Arresters Standard.

1.3 SUBMITTALS

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

.2 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: manufacturers' field reports specified.

□

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 Funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

.3 Acceptable Manufacturers: J R Smith, Mifab, Watts, Zurn.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron round, gasket.

2.3 WATER HAMMER ARRESTORS

.1 Copper construction, to PDI-WH201.

2.4 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, reduced pressure principle type.

.2 Acceptable Manufacturers: Watts

2.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral vacuum breaker, hose thread spout, replaceable composition disc.

2.6 WATER METERS

.1 Turbine type to AWWA C701 and as per City requirements.

□

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures [where indicated].

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.6 WATER METERS

.1 Install water meter provided by local water authority.

.2 Install water meter as indicated.

3.7 START-UP

.1 Timing: start-up only after:

.1 Pressure tests have been completed.
.2 Disinfection procedures have been completed.
.3 Certificate of static completion has been issued.
.4 Water treatment systems operational.

3.8 TESTING AND ADJUSTING

.1 Timing:

.1 After start-up deficiencies rectified.
.2 After certificate of completion has been issued by authority having jurisdiction.

□

.2 Application tolerances:

.1 Pressure at fixtures: ±[70] kPa.
.2 Flow rate at fixtures: ±20%.

.3 Floor drains:

.1 Check operations of flushing features.
.2 Check security, accessibility, removability of strainer.
.3 Clean out baskets.

.4 Vacuum breakers, backflow preventers:

.1 Test tightness, accessibility for O&M of cover and of valve.
.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
.3 Verify visibility of discharge from open ports.

.5 Access doors:

.1 Verify size and location relative to items to be accessed.

.6 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.7 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.8 Wall hydrants:

.1 Verify complete drainage, freeze protection.
.2 Verify operation of vacuum breakers.

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping.

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

.1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP69, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings and product data for following items:

- .1 Bases, hangers and supports.
- .2 Connections to equipment and structure.
- .3 Structural assemblies.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

- .1 Pipe hangers and supports: galvanized after manufacture.
- .2 Use hot dipped galvanizing process.
- .3 Ensure steel hangers in contact with copper piping are epoxy coated.

.2 Hanger rods: threaded rod material to MSS SP58:

- .1 Ensure that hanger rods are subject to tensile loading only.
- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .3 Do not use 22 mm or 28 mm rod.

.3 Pipe attachments: material to MSS SP58:

- .1 Attachments for steel piping: carbon steel galvanized.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.

.4 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.5 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.6 U-bolts: carbon steel to MSS SP69 with two (2) nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated.

.7 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.6 HOUSE-KEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 manufacturer's instructions and recommendations.

.2 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to industry standards.

.3 Steel pipes: install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: install below joint.

.3 Clevis plates:

.1 Attach to concrete with four (4) minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

.1 Plumbing piping: to Provincial Code and authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.6 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

3.7 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Part 1 - Submittals.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in Part 1 - Quality Assurance.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contact Administrator within 90 days of award of Contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this Contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 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 to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract documents before project construction is started and confirm in writing to Contact Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contact Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify Contact Administrator seven (7) days prior to start of TAB.

.1 Start TAB when building is essentially completed, including:

.2 Installation of ceilings, doors, windows, other construction affecting TAB.

.3 Application of weather-stripping, sealing, and caulking.

.4 Pressure, leakage, other tests specified elsewhere Division 23.

.5 Provisions for TAB installed and operational.

.2 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.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 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

.3 Liquid systems:

.1 Flushed, filled, vented.

.2 Correct pump rotation.

.3 Strainers in place, baskets clean.

.4 Isolating and balancing valves installed, open.

.5 Calibrated balancing valves installed, at factory settings.

.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: ±5%.

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within ±2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within three (3) months of TAB. Provide certificate of calibration to Contract Administrator.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Contract Administrator, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.
.2 System schematics.

.3 Submit TAB Report to Contract Administrator for verification and approval, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA, ASHRAE.

.2 Do TAB of systems, equipment, components, controls specified Division 23.

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 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 B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).

.2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.

.3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

.4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.

.6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.

.8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.

.9 ASTM C921, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.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 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.2 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 SAMPLES

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.5 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used and installation standards achieved.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24^{o}C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in Part 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in Part 3 of this Section).

.1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: Compatible with insulation.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:

.1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

.4 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.5 Contact adhesive: quick-setting

.6 Canvas adhesive: washable.

.7 Tie wire: 1.5 mm stainless steel.

.8 Banding: 19 mm wide, 0.5 mm thick stainless steel.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer’s instructions and as indicated.

.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: At 300 mm o/c in horizontal and vertical directions, minimum two (2) rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	Yes	50
Round cold and dual temperature supply air ducts	C-2	Yes	50
Exhaust duct between dampers and louvres	C-1	Yes	25

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation procedures for electric heating and cooling controls.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit 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 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:

.1 For use on 24 V circuit at 1.5 A capacity.

.2 Temperature setting range: 10 to 40 degrees Celsius.

.3 With sub-base.

2.2 CONTROLLER

.1 Electronic stand-alone controller for genset cooling and combustion air control.

.2 Points List:

.1 Genset On: Digital Input

.2 Space Temperature: Analog Input

.3 Combustion Air Damper: Digital Output (Normally Open)

.4 Outside and Exhaust Air Dampers: Analog Output (Normally Closed)

.5 Return Air Damper: Analog Output (Normally Open)

.3 Controller shall be capable of modulating outside, return and exhaust dampers to provide cooling during genset operation. Upon activation of genset, controller is enabled and combustion air damper opens. Controller modulates outside, return and exhaust dampers to maintain 25 degrees Celsius indoor air temperature.

.4 Standard of Acceptance: Honeywell T775, enclosure: NEMA-4X.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install control devices.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for piping, valves and fittings for gas fired equipment.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5, Pipe Flanges and Flanged Fittings.
.2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
.3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
.4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.

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

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
.3 ASTM B75M, Standard Specification for Seamless Copper Tube.
.4 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International)

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

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.
.2 CAN/CSA B149.2, Propane Storage and Handling Code.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
.2 Indicate on manufacturers catalogue literature following: valves.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.
.2 NPS2 1/2 and over, plain end.

.2 Copper tube: to ASTM B837.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Brazing: to ASTM B837.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.
.2 Steel pipe flanges and flanged fittings: to ASME B16.5.
.3 Welding: butt-welding fittings.
.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
.5 Bolts and nuts: to ASME B18.2.1.
.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ASME B16.18.
.2 Wrought copper fittings: to ASME B16.22.

2.4 VALVES

.1 Provincial Code approved, lubricated plug type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PIPING

.1 Install in accordance with applicable Codes, CAN/CSA B149.1, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Contract Administrator.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 PAINTING/IDENTIFICATION

.1 Painter exterior piping unless otherwise approved by Contract Administrator. Finish paint colour: grey.

3.5 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

.2 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports, in acceptable format, to verify compliance of work with Contract.

.3 Obtain reports within three (3) days of review and submit immediately to Contract Administrator.

3.6 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.

.2 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.7 CLEANING

.1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems, CAN/CSA B149.1, supplemented as specified.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

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

.3 National Fire Protection Association (NFPA).

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA HVAC Air Duct Leakage Test Manual.

.3 IAQ Guideline for Occupied Buildings Under Construction.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C

Maximum Pressure Pa	**SMACNA Seal Class**
125	C
125	Unsealed

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape, or combination thereof. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C to 93°C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.

.1 Rectangular: standard radius. Centreline radius: 1.5 times width of duct.

.2 Round: five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Full radiused elbows.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports:

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA following table:

Duct Size (mm)	**Angle Size** (mm)	**Rod Size** (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps.

.4 For wood trusses: steel plate washer

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA.

.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size (mm)	**Spacing** (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one (1) coat of sealant to manufacturers recommendations.

3.4 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Make trial leakage tests as instructed to demonstrate workmanship.

.3 Do not install additional ductwork until trial test has been passed.

.4 Complete test before performance insulation or concealment Work.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections

.2 Duct access doors

.3 Turning vanes

.4 Instrument test ports

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturer's Field Reports: manufacturer's field reports specified.

.7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40°C to 90°C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one (1) sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: foam rubber.

.4 Hardware:

.1 Up to 300 x 300 mm: two (2) sash locks

.2 301 to 450 mm: four sash locks

.3 Hold open devices

2.4 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.5 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:
- .1 Inlets and outlets to supply air units and fans
- .2 Inlets and outlets of exhaust and return air fans
- .3 As indicated

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:
- .1 Ducting on sides of flexible connection to be in alignment
- .2 Ensure slack material in flexible connection

.2 Access Doors and Viewing Panels:

.1 Size:
- .1 450 x 450 mm for servicing entry
- .2 150 x 150 mm for viewing
- .3 As indicated

.2 Locations:
- .1 Devices requiring maintenance
- .2 Required by code
- .3 Elsewhere as indicated

.3 Instrument Test Ports:

.1 General:
- .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Locate to permit easy manipulation of instruments.

.3 Install insulation port extensions as required.

.4 Locations:
- .1 For traverse readings:
  - .1 Ducted inlets to roof and wall exhausters
  - .2 Inlets and outlets of other fan systems
  - .3 Main and sub-main ducts
  - .4 And as indicated
- .2 For temperature readings:
  - .1 At outside air intakes
  - .2 In mixed air applications in locations as indicated
  - .3 At inlet and outlet of coils
  - .4 Downstream of junctions of two (2) converging air streams of different temperatures
  - .5 As indicated

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

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

1.3 SUBMITTALS

.1 Product Data:

.1 Submit 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 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed blade type.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operators: equal to Belimo EF Series MFT.

.6 Performance:

.1 Leakage: in closed position less than 10% of rated air flow at 1 kPa differential across damper.

.2 Pressure drop: at full open position less than 25 Pa differential across damper at 5 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.44.

.2 Blades: constructed from aluminum extrusions thermally broken with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.44.

.8 Acceptable Manufacturers: Greenheck, Price, Ruskin, Ventex,

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of flexible ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 National Fire Protection Association (NFPA).

.1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.3 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction.

.4 Underwriters' Laboratories Inc. (UL).

.1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.

.5 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S110, Fire Tests for Air Ducts.

1.3 SUBMITTALS

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

Part 2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Type 1: spiral wound flexible stainless steel, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

2.3 METALLIC - INSULATED

.1 Type 2: spiral wound flexible aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation with vapour barrier and reinforced mylar/neoprene laminate jacket, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.2 Maximum relative pressure drop coefficient: 3.

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Fans, motors, accessories and hardware for commercial use.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99, Standards Handbook.
.2 AMCA 300, Reverberant Room Method for Sound Testing of Fans.
.3 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

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

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
.2 Capacity: flow rate, external static pressure, bhp (W), efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
.4 Sound ratings: comply with AMCA 301, tested to AMCA 300.
.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit 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 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide:

.1 Fan performance curves showing point of operation, BHP (kW) and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 FANS GENERAL

.1 Motors:

.1 For use with variable speed controllers.

.2 Sizes as indicated.

.2 Factory primed before assembly in colour standard to manufacturer.

.3 Scroll casing drains: as indicated.

.4 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 IN-LINE CENTRIFUGAL FANS

.1 Standard of Acceptance: refer to M-1.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings, flexible electrical leads and flexible connections.

.2 Access doors and access panels to be easily accessible.

CLEANING

.3 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)

.1 ANSI/NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

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

.1 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.4 Society of Automotive Engineers (SAE)

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit 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 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

Part 2 Products

2.1 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: minimum 3mm thick with reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: anodized. Colour: to Contract Administrator's approval.

.9 Acceptable Manufacturers: Greenheck, Price, Ruskin, Ventex.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.46, Electric Air-Heaters.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data sheets for unit heaters. Include:

.1 Product characteristics
.2 Performance criteria
.3 Mounting methods
.4 Physical size
.5 kW rating, voltage, phase
.6 Cabinet material thicknesses
.7 Limitations
.8 Colour and finish

.3 Submit product data sheets for unit heaters.

.1 Include product characteristics, performance criteria, physical size, limitations and finish.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet.

.2 Hangers: as indicated.

2.2 MANUFACTURERS

.1 Standard of Acceptance: refer to Drawing M-1.

Part 3 Execution

3.1 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Make power and control connections.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements that are common to NMS sections found in Section 26 – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 City of Winnipeg Water and Waste Department – Electrical Design Guide, Rev 01

.5 City of Winnipeg Water and Waste Department – Automation Design Guide, Rev 00

.6 City of Winnipeg Water and Waste Department – Identification Standard, Rev 00

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

1.4 SUBMITTALS

.1 Quality Control:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to Site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of Contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.2 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in Part 3 - Field Quality Control.

1.5 QUALITY ASSURANCE

.1 Quality Assurance:

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.6 SYSTEM STARTUP

.1 Instruct City’s personnel in operation, care and maintenance of systems, system equipment and components.

.2 Assist City’s personnel and the Contract Administrator in the start-up of equipment.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.7 Site

.1 Classification of Plant Areas

.1 Building: Ordinary

.2 Dry Well: Category 1

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to Site and submit such approval as described in Part 1 - Submittals.

.2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Division 29.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 Lamacoid signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, white with black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping stainless steel screws.

.2 Lamacoids as follows:

Application	**Text Size**	**Text**
Electrical Equipment - General	5 mm	Line 1: Identifier
Circuit Breaker - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Disconnect Switch - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Fire Alarm Devices	8 mm	Line 1: Identifier
Light Switches	3 mm	Source Panel and Circuit Number
Motor Control Centre	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Motor Starter or MCC Bucket	5 mm	Line 1: Load Identifier Line 2: Load Description
Panelboards	8mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Receptacles	3 mm	Source Panel and Circuit Number

Application	Text Size	Text
Switchgear	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Switchgear Breaker	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Transformer - Indoor	8 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By
Transformer – Outdoor	10 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By

.2 Wording on nameplates to be approved Contract Administrator prior to manufacture.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes, and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

.4 Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White

	Prime	**Auxiliary**
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

.5 Cable Colour Codes

	Prime	**Auxiliary**
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Control panels: as indicated.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays, and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

.1 Conduct following tests:

.1 Circuits originating from branch distribution panels.

.2 Lighting and its control.

.3 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.2 Carry out tests in presence of Contract Administrator.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of Project.

3.6 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No.131, Type TECK 90 Cable.

Part 2 Products

2.1 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No.131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One-hole stainless steel straps to secure surface cables 50 mm and smaller. Two-hole stainless steel straps for cables larger than 50 mm.

.2 Channel type supports for two (2) or more cables at 900 mm centers.

.3 Stainless steel threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors

2.2 CONTROL CABLES

.1 Type LVT: soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 600 V type: stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, or cross-linked polyethylene type RW90 (x-link with shielding ofmetallized tapes over each pair of conductors and overall covering of thermoplastic jacket interlocked armour and jacket over sheath of PVC.

Part 3 Execution

3.1 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Lay cable in cabletroughs/cable tray in accordance with Section 26 05 36.

.3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.2 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.

.3 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Insulated grounding conductors: green, type RW90.

.6 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

□

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.10 Ground secondary service pedestals.

3.2 ELECTRODES

.1 Install rod electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use size 2/0AWG copper conductors for connections to electrodes.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

□

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections sized in accordance with the Canadian Electrical Code.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to Site conditions and to approval of Contract Administrator.

.3 Perform tests before energizing electrical system.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Not Used

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape aluminum, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole stainless steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole stainless steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.

.2 Support two (2) or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1 m on center spacing.

.8 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three (3) spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, two (2) keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one (1) system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one (1) conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

.1 Electro-glavanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45, Rigid Metal Conduit.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2 Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One-hole aluminum or stainless steel straps to secure surface conduits 50 mm and smaller. Two-hole aluminum or stainless steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1 m oc.

.4 Stainless steel threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

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2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 X-ray cast walls and floors before coring to confirm location of embedded items.

.3 Existing structure may contain asbestos. Confirm materials are free of asbestos before drilling or coring.

.4 Use rigid aluminum threaded conduit in all areas.

.5 Use epoxy coated conduit underground and in cast concrete.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

.7 Minimum conduit size for lighting and power circuits: 19 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 19 mm dia.

.10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.11 Install fish cord in empty conduits.

.12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

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3.2 SURFACE CONDUITS

.1 Paint walls before installation of electrical equipment including conduits.

.2 Run parallel or perpendicular to building lines.

.3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.4 Run conduits in flanged portion of structural steel.

.5 Group conduits wherever possible on suspended or surface channels.

.6 Do not pass conduits through structural members except as indicated.

.7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than four (4) times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

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.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After 75 mm sand bed, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Make termination and splice only as indicated leaving 0.6 m of surplus cable in each direction.

.1 Make splices and terminations in accordance with manufacturer's instructions using approved splicing kits.

.4 Underground cable splices not acceptable.

.5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, eight (8) times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.6 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

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.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

.6 Install treated planks on lower cables 0.6 m in each direction at crossings.

.7 After 75 mm sand protective cover spec is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 150 m along cable and duct runs and changes in direction.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Install concrete cable markers within 180 m from each side of runway centerline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.

.5 Install cedar post type markers.

.6 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

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.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.7 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

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Part 1. General

1.1. REFERENCES

.1 CAN3-C17, Alternating - Current Electricity Metering

.2 ANSI/IEEE C37.90A surge withstand and fast transient tests

1.2. PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00 – Common Work Results - For Electrical.

.2 Indicate meter, instrument, outline dimensions, panel drilling dimensions and include cutout template.

Part 2. Products

2.1. DIGITAL METERING INSTRUMENT

.1 Microprocessor-based data collection and storage meter to monitor power conditions on transformer secondaries as shown on the plans.

.2 Meter to display true RMS value of:

.1	Amps	3-phase current
.2	Volts	Line-to-line or line-to-neutral 3-phase voltage
.3	kW	kilowatts
.4	kVA	kilovoltamperes
.5	Pf	power factor
.6	F	frequency
.7	kWd	kilowatt demand
.8	Ad	amperes demand
.9	kWh	kilowatt hours

.10 Total kWH as an accumulating total, providing bi-directional (import/export) indication.

.11 Total kVARH as an accumulating total, providing bi-directional (import/export) indication.

.12 kW Demand, user-programmable length of each demand period and the number of periods averaged to match local utility billing method.

.13 Amps Demand

.14 kVA Demand, user-programmable length of each demand period and the number of periods averaged to match local utility billing method.

.15 Total harmonic current and voltage

.16 Individual harmonic true rms current and voltage to the 63rd harmonic

.3 Each power meter to have:

.1 True RMS measurement.

.2 Direct connection to 600 V, 3-phase, 4-wire system.

.3 Fourth current input for measurement of ground or neutral current.

.4 Eight (8) digital inputs for status/counter inputs, self-excited dry contact sensing, to remotely monitor breaker status, ground fault relay status, or any other dry contact input.

.5 Storage in non-volatile memory for the following:

.1 A time-stamped alarm and event log of up to 800 events which records event date, time (to 0.001 sec), event type, and value for all over/under limit conditions, all status input activity, and all relay operations.

.2 A time-stamped minimum/maximum log, which records the value of any parameter exceeding the previous highest or lowest value recorded. Log to be read from the front panel display or via the communications port.

.3 All setup data.

.6 Waveform capture capability allowing any of the eight voltage and current input channels to be digitally sampled at 256 samples/60 Hz cycle. Waveform capture to be initiated using commands made via the communications port or event triggered. Waveform capture data is to be made accessible via the communications port.

.7 Liquid crystal display, 320 x 240 pixels resolution, backlight.

.8 Serial communications ports:

.1 One (1) RS-232C/RS-485, and one (1) RS-485

.2 Protocols:Modbus RTU

.3 Baud rate: RS-232, 300 bps to 115,200 bps.

.4 Baud rate: RS-485, 300 bps to 57,600 bps.

.9 Ethernet port:

.1 Protocols:Modbus TCP

.2 10BaseT

.10 Field programmability as follows:

.1 Volts scale, volts mode (wye, delta, single phase), amps scale, Vaux scale, baud rate, TCP/IP address and the relay operation are programmable from the front panel.

.2 All parameters in 10.1 above, plus additional alarm/event parameters may be programmed via the communications port using a portable terminal or a computer.

.3 Ensure programming is password protected.

.11 Compliance with the following standards:

.1 ULC certified

.2 CSA approved

.3 Voltage, current, status, relay and power inputs pass the ANSI/IEEE C37.90A surge withstand and fast transient tests.

.4 Certified to comply with FCC Part 15 Subpart J for Class A computing devices.

.12 300 amps for one (1) second surge protection on all four (4) current inputs.

.13 The following accuracy, resolution, range, and power supply ratings specifications:

Parameter	Accuracy	Resolution	Range
Volts (V1, V2, V3)	0.1%	0.1%	0 - 1,000,000[1]
Amps (I1, I2, I3)	0.1%	0.1%	0 - 30,000
Neutral Current (I4)	0.4%	0.1%	0 - 9,999
kW	class 0.2	0.1%	0 - 1,000,000[2]
kVAR	class 0.2	0.1%	0 - 1,000,000[2]
kVA	class 0.2	0.1%	0 - 1,000,000[2]
Power Factor	0.2%	1.0%	1.0 to ±0.6
Frequency	0.005 Hz	0.1 Hz[3]	40 to 450 Hz

Parameter	Accuracy	Resolution	Range
kW Demand	class 0.2	0.1%	0 - 1,000,000
Amps Demand	class 0.2	0.1%	0 - 30,000
kWH (-F, -R)	class 0.2	1 kWH	0 - 1,000,000,000
kVARH (-F, -R)	class 0.2	1 kVARH	0 - 1,000,000,000

.1 Reads in kV for voltages over 9,999

.2 Reads in MVA, MW, MVAR for readings over 9,999 K

.3 1 Hz resolution at 400 Hz range

.4 Power Supply

.1 85 to 250 VAC or 110 to 300 VDC

.2 Burden: 15 VA typical, 35 VA maximum

.3 Record and store the following information in meter memory. Recall and reset stored data via meter controls and meter indicator.

.1 Volts max/min at 1 second interval

.2 Amps max/min at 1 second interval

.3 F max/min at 1 second interval

.4 kW max/min at 1 second interval

.5 Pf max/min (or kVA max/min) at 1 second interval

.6 kWd at field programmable intervals of 1 minute to 30 minutes; set at 1 minute

.7 Ad per kWd

.5 10-Base-T communications port for future addition of remote data acquisition.

.6 Field programmable for set-up and system variables.

.7 Test terminal blocks as required.

.8 Relay output signalling loss of phase. Relay to open on phase loss.

.9 CSA approved

.10 Approved Product: Schneider Electric PowerLogic ION7400, Eaton Power Xpert Meter 4000

2.2. CURRENT TRANSFORMERS

.1 Provide shorting switches or test blocks for all meter CT inputs

2.3. EQUIPMENT IDENTIFICATION

.1 Provide equipment identification.

Part 3. EXECUTION

3.1. METERING INSTALLATION

.1 Install meters in panels as indicated

.2 Make connections in accordance with diagrams

.3 Connect phase loss relay to RTU control panel.

3.2. FIELD QUALITY CONTROL

.1 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.2 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).
- .2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47.

.2 Design.

- .1 Type: ANN.
- .2 Windings: Copper
- .3 Rating as specified.
- .4 Voltage taps: standard.
- .5 Insulation: 180 degrees C temperature rise.
- .6 Basic Impulse Level (BIL): standard.
- .7 Hipot :standard.
- .8 Average sound level: standard
- .9 Impedance at 17 degrees C: standard
- .10 Enclosure: CSA 1, removable metal front panel c/w sprinkler sheild.
- .11 Finish: in accordance with Section 26 05 00 - Common Work Results - Electrical.

□

.12 Acceptable manufactures: Schneider Electric, Eaton, Rex Manufacturing.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Nameplate wording example:

T-2
15kVA
600V – 120/208V

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Energize transformers after installation is complete.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one (1) manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 600 V panelboards: bus and breakers rated for 18kA (symmetrical) interrupting capacity or as indicated.

.3 250 V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity or as indicated.

.4 Panelboard width to be less than 230 mm.

.5 Integral TVSS.

□

.6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.7 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.8 Two (2) keys for each panelboard and key panelboards alike.

.9 Copper bus with neutral of same ampere rating as mains.

.10 Mains: suitable for bolt-on breakers.

.11 Trim with concealed front bolts and hinges.

.12 Trim and door finish: baked grey enamel.

.13 Approved manufacture: Schneider Electric, Eaton

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Lock-on devices for fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on U-channel. Where practical, group panelboards on common supports.

□

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Measure load current on each phase and adjust phase loading for a balanced system.

END OF SECTION

□

Part 1 GENERAL

1.1 RELATED WORK

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-Q9000, Quality Management and Quality Assurance Standards - Guidelines for Selection and Use.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Outline dimensions

.2 Configuration of identified compartments.

.3 Floor anchoring method and dimensioned foundation template.

.4 Cable entry and exit locations.

.5 Dimensioned position and size of busbars and details of provision for future extension.

.6 Schematic and wiring diagrams.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor control centre for incorporation into manual.

.2 Include data for each type and style of starter.

1.6 EXTRA MATERIALS

.1 Provide maintenance materials.

.2 Include: five (5) control fuses, control transformer, H-O-A selector switch and contact blocks, five (5) lamps

□

Part 2 PRODUCTS

2.1 Supply Characteristics

.1 600 V, 60Hz, amperage as indicated on plans, wye connected, 3-phase, 4-wire, grounded neutral.

.2 Fault current: 18kAIC

2.2 General Description – 4-Plex Grouped Motor Control

.1 NEMA 12 enclosure, wall mounted.

.2 Compartmentalized sections with common power busbars.

.3 Wall mounting.

.4 Class I, Type B complete with pull-apart terminals.

.5 Approved Manufacture: SquareD, Eaton.

2.3 Busbars

.1 Main three phase and neutral high conductivity tin plated copper busbars in separate compartment bare self-cooled, extending entire width motor control centre, supported on insulators and rated:

.1 Busbars: 100 A.

.2 No other cables, wires, equipment in main and branch busbar compartments.

.3 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical.

.4 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.4 Ground Bus

.1 Copper ground bus extending entire width of motor control centre.

2.5 Motor Starters and Devices

.1 Rated 18kAIC.

.2 See **Section 26 29 10 - Motor Starters to 600 V.**

2.6 Starter Unit Compartments

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type

.2 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for three (3) padlocks to lock operating handle in "off" position and lock door closed.

.3 Hinge unit doors on same side.

.4 Overload relays manually reset from front with door closed.

.5 Pushbuttons and indicating lights mounted on door front.

□

.6 Devices and components by one (1) manufacturer to facilitate maintenance.

.7 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.7 Wiring Identification

.1 Provide wiring identification in accordance with **Section 26 05 00 - Common Work Results - For Electrical.**

2.8 Equipment Identification

.1 Provide equipment identification in accordance with **Section 26 05 00 - Common Work Results - For Electrical.**

.1 Motor control centre main nameplate: size No. 7, engraved as indicated.

.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.9 Finishes

.1 Apply finishes in accordance with **Section 26 05 00 - Common Work Results - For Electrical.**

.2 Paint motor control centre exterior light gray and interiors white.

2.10 Source Quality Control

.1 Provide Manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.

.2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

.3 Manufacturer to provide proof of quality control program in accordance with CAN/CSA-Q9000.

Part 3 EXECUTION

3.1 Installation

.1 Make field power and control connections as indicated.

.2 Ensure correct overload heater elements are installed.

3.2 Field Quality Control

.1 Perform tests in accordance with **Section 26 05 00 - Common Work Results - For Electrical**.

.2 Ensure moving and working parts are lubricated where required.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SWITCHES

.1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire

.2 Silver alloy contacts

.3 Urea or melamine moulding for parts subject to carbon tracking

.4 Suitable for back and side wiring

.5 Ivory toggle

.3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

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.5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

- .1 Ivory urea moulded housing
- .2 Suitable for No. 10 AWG for back and side wiring
- .3 Break-off links for use as split receptacles
- .4 Eight (8) back wired entrances, four side wiring screws
- .5 Triple wipe contacts and rivetted grounding contacts

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

- .1 Ivory urea moulded housing
- .2 Suitable for No. 10 AWG for back and side wiring
- .3 Four (4) back wired entrances, 2-side wiring screws

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet stainless steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Stainless steel or cast aluminum cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one (1) switch is required in one (1) location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers with ampacity of 90 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees Celsius ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from three (3) to eight (8) times current rating.

.5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating matching panel board or switchboard containing breaker.

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2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS [DESIGN B]

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS [DESIGN D]

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Set adjustable trip settings according to coordination study.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - For Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Heavy duty non-fusible, horsepower rated disconnect switch to CAN/CSA C22.2 No.4.

.2 Provision for padlocking in OFF position.

.3 Quick-make, quick-break action.

.4 ON-OFF switch position indication on switch enclosure cover.

.5 Category 1 locations: NEMA 4.

.6 Category 2 locations: NEMA 4x.

.7 Ordinary locations: NEMA 12.

.8 Outdoor: NEMA 3.

.9 Acceptable Manufacturer: Square D, Eaton, Hubbell, Pass & Seymour, Leviton.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - For Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated and as required by CSA C22.1.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit to Contract Administrator copy of test results.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14.

.2 Fixed contact plug-in type: general purpose heavy duty with two (2) poles. Coil rating: 120 V. Contact rating: 240V, 2 A.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

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2.3 OILTIGHT LIMIT SWITCHES

.1 Snap action type: roller, rod, fork, lever, top, side, push, wobble stick actuator, CSA type 4 enclosure. Contact rating 240VAC, 2A

2.4 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact.

.2 Operation: on-delay or off-delay.

.3 Potentiometer: self contained to provide time interval adjustment.

.4 Supply voltage: 120 V, AC, 60 Hz.

.5 Temperature range: minus 20 to 60 degrees Celsius.

.6 Output contact rating: maximum voltage 300 V AC or DC. Current: 2A

.7 Timing ranges: field adjustable, minimum 0.1s, maximum 60 hours.

2.5 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 4, surface mounting:

2.6 PUSHBUTTONS

.1 Illuminated, Heavy duty Oil tight. Operator extend type, as indicated. Black, with 2-NO and 2-NC contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red. Start pushbuttons coloured green

2.7 SELECTOR SWITCHES

.1 Maintained 3 position labelled as indicated heavy duty oil tight, operators wing lever contact arrangement as indicated, rated 120 V, 10A, AC.

2.8 INDICATING LIGHTS

.1 Heavy duty Oil tight, full voltage, LED type, push-to-test, lens colour: as indicated, supply voltage: 120 V, lamp voltage: 120 V, labels as indicated.

2.9 CONTROL AND RELAY PANELS

.1 CSA Type 12 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.10 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

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.2 Primary: 600 V, 60 Hz ac.

.3 Secondary: 120 V, AC.

.4 Rating: 150 VA, or larger as required.

.5 Secondary fuse: ampacity as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.11 THERMOSTAT LINE VOLTAGE

.1 Wall mounted, for exhaust fan control.

.2 Full load rating: 8A at 120 V.

.3 Temperature setting range: 0 to 30 degrees Celsius.

.4 Thermometer Range: 0 to 30 degrees Celsius.

.5 Markings in 5 degree increments.

.6 Differential temperature fixed at 1 degree Celsius.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 NEMA contactors and motor starters

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual.

.2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials.

.2 Provide listed spare parts for each different size and type of starter:

.1 Three (3) contacts, stationary.
.2 Three (3) contacts, movable.
.3 One (1) contacts, auxiliary.
.4 One (1) control transformer[s].
.5 One (1) operating coil.
.6 Two (2) fuses.
.7 10% indicating lamp bulbs used.

□

Part 2 Products

2.1 MATERIALS

.1 Starters: NEMA standards, IEC rated equipment not allowed.

2.2 MANUAL MOTOR STARTERS

.1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.
.2 One overload heater, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch, heavy duty oil tight labelled as indicated.
.2 Indicating light: heavy duty oil tight, LED type and colour as indicated.
.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Provide control signal interface to existing RTU Control panel.

.2 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.
.2 Motor overload protective device in each phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside starter enclosure in visible location.
.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
.5 Hand-Off-Auto selector switch mounted on starter door.
.6 Red running light.
.7 Green stopped light.
.8 Amber alarm light.

.3 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control disconnect motor circuit interrupter, and provision for:

.1 Locking in "OFF" position with up to three (3) padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Accessories:

.1 Pushbuttons and selector switches: heavy duty, oil tight labelled as indicated.
.2 Indicating lights: heavy duty, oil tight, LED type and color as indicated.

□

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Manual starter designation label, black plate, white letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, black plate, white letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 Confirm operation of motor starters from RTU Control System.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for liquid cooled electric generating unit.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

.1 Canadian Standards Association, (CSA International)

.1 CAN3-Z299.3, Quality Assurance Program - Category 3
.2 CAN/CSA-C282-00, Emergency Electrical Power Supply for Buildings
.3 CSA B149.1-00 Natural Gas and Propane Installation Code

.2 International Organization for Standardization (ISO)

.1 ISO 3046-1, Reciprocating internal combustion engines - Performance - Part I: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.
.2 ISO 3046-4, Reciprocating internal combustion engines - Performance - Part 4: Speed governing.

.3 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1, Motors and Generators

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - [March 1998]

.5 The Society of Automotive Engineers (SAE)

1.4 SYSTEM DESCRIPTION

.1 Installation and commissioning of City supplied automatic, unattended, standby power supply system consisting of:

.1 Liquid cooled low voltage natural gas electric generating unit with combined control, and transfer panel.
.2 Accessories and equipment specified in this specification.

.2 Provide installation, testing, transportation, demonstration, and commissioning.

.3 Contractor to provide loading, transportation and offloading of equipment from:

598 Plinguet
Winnipeg, Manitoba
R2J 2W7

1.5 DESIGN REQUIREMENTS

1.6 QUALITY ASSURANCE

.1 Do Work in accordance with CAN3-Z299.3.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Prepare, crate, and protect equipment against shipping and storage damage.

Part 2 Products

2.1 ASSEMBLY

.1 The following City supplied include the following items plus such other items as necessary to make unit complete:

.1 Natural Gas Engine
.2 Engine Accessories
.3 Baseplate and Drip Pan
.4 Vibration isolators
.5 Governor
.6 Engine Exhaust System
.7 Engine Cooling System
.8 Engine Ventilating System
.9 Starting Motor
.10 Batteries and Rack
.11 Battery Charger
.12 Generator and Exciter
.13 Voltage Regulator and Accessories
.14 Combined Control, Transfer Panel
.15 Spares and Accessories

2.2 QUALITY CONTROL

.1 Assist the equipment supplier with installation verification.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with manufactures specifications.

.2 Provide installation, start-up, and commissioning assistance to the equipment supplier contractor.

3.2 TRAINING

.1 Coordinate with the equipment supplier to provide demonstration and training to City staff.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads, and shut down standby unit.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN3-C13, Instrument Transformers

.2 CSA C22.2No.5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE)

.3 CSA C22.2No.178, Automatic Transfer Switches

.2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC

1.4 SYSTEM DESCRIPTION

.1 Installation and commissioning of City supplied automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one (1) phase below pre-set adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

.2 Contractor to provide loading, transportation, and offloading of equipment from:

598 Plinguet
Winnipeg, Manitoba
R2J 2W7

1.5 QUALITY ASSURANCE

.1 Do Work in accordance with CAN3-Z299.3.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Prepare, crate, and protect equipment against shipping and storage damage.

Part 2 Products

2.1 MATERIALS

.1 City supplied automatic transfer switch.

2.2 QUALITY CONTROL

.1 Assist the equipment supplier with installation verification.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with manufactures specifications.

.2 Provide installation, start-up, and commissioning assistance to the equipment supplier.

3.2 TRAINING

.1 Coordinate with the equipment supplier to provide demonstration and training to City staff.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.7 Repeat, at one (1) hour intervals, four (4) times, complete test with selector switch in each position, for each test.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS OF WORK

.1 Supply, install and commissioning a complete instrumentation and control (I&C) system for the pumping station as shown on the Drawings and as specified herein.

.2 Component subsystems of the I&C system will include, but are not limited to, the following:

- .1 Primary elements and transmitters
- .2 Final control elements
- .3 RTU control panels
- .4 Instrumentation cabling
- .5 Instrumentation power supplies
- .6 Conduit and cable tray

.3 Where packaged, stand-alone control systems are supplied by others provide cabling to connect to the required remote monitoring and/or control functions. Provide end-to-end Commissioning of all required remote monitoring and/or control functions. Assist in ensuring the correct functionality of any equipment supplied by others.

.4 Documentation referred to in 1.1.1 to include as a minimum:

- .1 Records of as-built information for the complete instrumentation system.

.5 Documentation provided is formatted as follows:

- .1 Location Drawings – indicate in plan and/or elevation views where the instrument elements are physically located. These Drawings are provided to assist the Contractor in estimating the amount of cable and ducting required.
- .2 Standard Details – provide a reference for installation, operation and other instructions pertinent to a particular device.
- .3 Detailed Specification – lists qualifications, quality of materials and workmanship, and supplementary information.

.6 Definitions

- .1 Interpret specialized terms not explicitly defined herein in accordance with ISA-S51.1, NEMA-ICS-1, ANSI/IEEE-Std-100, and The Communications Standard Dictionary, by Martin H. Weik.

.7 References

- .1 This Specification contains references to the following Documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed Documents, the requirements of this Section prevail.

Reference	**Title**
API RP550	Manual on Installation of Refinery Instruments and Control Systems, Part I--Process Instrumentation and Control Sections 1 Through 13
ASME Section VII	Rules for Construction of Pressure Vessels
ASTM B68	Seamless Copper Tube
ASTM D883	Terms Relating to Plastics
IEEE 100	Dictionary of Electrical and Electronic Terms
ISA RP7.1	Pneumatic Control Circuit Pressure Test
ISA RP12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
ISA S5.4	Instrument Loop Diagrams
ISA S18.1	Annunciator Sequences and Specifications
ISA S51.1	Process Instrumentation Terminology
NEMA 250	Enclosures for Industrial Controls and Systems
NEMA ICS 1	General Standards for Industrial Control and Systems
NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
NFPA 70	National Electrical Code (NEC)
SAMA PMC 17-10	Bushings and Wells for Temperature Sensing Elements
UBC	Uniform Building Code
UL 1012	Power Supplies
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Weik, Martin H. Communications Standard Dictionary, Van Nostrand Reinhold Co.

.8 Related Work:

.1 Mechanical

.2 Electrical

.9 Qualifications

.1 The instrumentation Subcontractor shall be a firm normally engaged and fully competent in the type of Work described in this Section of the Specification. The firm shall have been continuously and successfully engaged in this business for at least five years.

.2 Qualified journeyman instrument mechanics that are familiar with the devices being installed shall perform all instrument hook-ups, calibrations, and checkouts.

.3 Qualified journeyman electricians shall perform all control wiring installation and connections.

.10 Codes, Rules, Permits, and Fees

.1 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

.2 Comply with all rules of the Electrical Safety Act of the Province, CSA Standards, the ULC and the applicable building codes, whether specifically shown on Drawings or not.

.3 Give all required notices, submit Drawings, obtain all permits, licenses and certificates and pay all fees required for this Work.

.4 Furnish a certificate of final inspection and approvals from an inspection authority to the Contract Administrator.

.11 Standards of Workmanship

.1 Execute all Work in a manner, which will result in the completed installation presenting an acceptable appearance, to a level of quality defined in the general conditions of this Specification.

.2 Employ a competent supervisor and all necessary licensed tradesmen to complete the Work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Install products in accordance with the recommendations and ratings of the product manufacturers.

.12 Contract Drawings and Specifications

.1 Refer to Division 1.

.2 Provide all items and accessories required to install the City supplied equipment.

.3 Perform all operations as designated by the Specification according to the methods prescribed, complete with all necessary labour and incidentals.

.4 Treat any item or subject omitted from this Division's Specifications or Drawings, but which is mentioned or reasonably specified in other Divisions' Specifications or Drawings and pertains to the instrumentation and control system, as being integral to the overall system. Provide such specified items or subjects.

.5 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.6 If discrepancies or omissions in the Drawings or Specifications are found, or if intent or meaning is not clear, consult the Contract Administrator for clarification before submitting bid.

1.2 EQUIPMENT

.1 Receiving, Storing, and Protection of Components during Construction

.1 Examine each component upon delivery to Site. Report all damage noted to the Contract Administrator prior to accepting or rejecting delivery. All instrumentation primary elements, control components, panels, etc. shall be placed in a secure, dry, heated storage building. Maintain the space temperature above 10°C and the space relative humidity below 50%.

.2 Perform a preliminary examination upon delivery to ensure that:

.1 All instrumentation and control components supplied for this project under this Section of the Specification comply with the requirements stated in the instrument Specification sheets.

.2 All instrumentation and control components supplied by others, to be connected to instrumentation and control components comply with the requirements stated in the Contract Documents.

.3 Itemize all non-conformities noted above and forward them to the Contract Administrator.

.4 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Contract Administrator prior to installing any equipment of this type.

.5 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage.

Return all damaged equipment to the supplier for total corrective repairs. If deemed necessary by the Contract Administrator, the damaged equipment shall be replaced with new product.

1.3 SITE

.1 Classification of Plant Areas

.1 Building: Ordinary

.2 Dry Well: Category 1

1.4 DOCUMENTATION

.1 Submittals

.1 Submit Shop Drawings for all products supplied by this Division.

.2 Shop Drawings for the City supplied equipment will be provided to the Contractor

.2 Construction Record Drawings

.1 Maintain on-site a complete set of Construction Record Drawings as listed in Division 1 of this Specification.

.2 In addition to the requirements as stated in Division 1, record the following information on the Drawings:

.1 All changes, alterations or additions;

.2 All instrumentation cable and control tubing; and,

.3 All changes to the numbers and location of outlets, motors, panels and end devices that may occur during the course of the Work.

.3 Before requesting the Certificate of Total Performance, make any necessary final corrections to the Drawings, sign each print as a certification of accuracy and deliver all sets to the Contract Administrator for approval.

Part 2 Products

2.1 GENERAL

.1 Refer to the requirements of Division 1.

.2 Selected Products:

.1 Provide products and materials that are new and free from all defects.

.2 The design has been based on the use of the first named product where multiple products have been listed.

.3 Quality of Products

.1 All products provided to be CSA and ULC approved where applicable.

.2 If products specified are not CSA approved, obtain approval of the relevant provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Refer to Division 1 of this Specification for further information.

.4 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specification, uniformity of manufacture to be maintained for similar products throughout the Work.

.5 Use of Products During Construction

.1 Any equipment used for temporary or construction purposes is to be approved by the Contract Administrator. Clean and restore to "as new" condition all equipment prior to the time of Substantial Performance.

2.2 INSTRUMENTATION

.1 General

.1 Instruments and installation methods to be suitable for the environmental conditions in which they are to be installed.

.2 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

2.3 IDENTIFICATION

.1 Refer to City of Winnipeg Water and Waste Department – Identification Standard, Rev 00 for general identification requirements.

.2 Provide 3 mm thick lamicoid nameplates with 6 mm black lettering on white background. Identify the loop tag number (where applicable) and the device name, function, and instrument range or setpoint value on the nameplate.

.3 Where it is not possible to attach a lamicoid nameplate to a field instrument component, provide the component with a stainless steel metal tag firmly wired to the device and identified with the loop tag number.

.4 Identify all wires where they terminate at the marshalling panels, junction boxes and field devices with a heat shrink sleeve with machine printed labelling.

.5 Clearly mark all panels, pull boxes, junction boxes, etc. to indicate the nature of service.

.6 Provide neatly typed circuit directories for panel power distribution systems to indicate loops or devices powered by the circuit and the fuse size.

.7 Identify all exposed control conduits at all pull box locations, where the conduits enter or leave a room, and 13 m on center throughout the room. This shall apply to conduits above removable ceilings. Use Thomas & Betts TY-RAP 5532-M labels conduit identification.

.8 For direct current wiring use black for positive and white for negative.

.9 For thermistor wiring to motors use red and blue coloured, insulated wire.

Part 3 Execution

3.1 SITE EXAMINATION

.1 Refer to the requirements of Division 1.

.2 No additional compensation will be given for extra Work due to existing conditions that a Site examination prior to Bid should have disclosed.

3.2 COORDINATION WITH OTHER DIVISIONS

.1 Examine the Drawings and Specifications of all Divisions and become fully familiar the Work. Before commencing Work, obtain a ruling from the Contract Administrator on any conflicting issues between Divisions. No compensation will be made for any costs arising from conflict not identified before Work has commenced.

.2 Coordinate the Work to be performed under this Section of the Specification with all Divisions installing equipment to ensure that there are no conflicts.

.3 Install anchors, bolts, pipe sleeves, hanger inserts, etc. required in ample time to prevent delays to other Division's installation Work.

.4 Lay out the Work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural Drawings take precedence over electrical Drawings regarding locations of walls, doors, and equipment.

.5 Structural members shall not be cut without prior approval of the Contract Administrator.

.6 Examine previously constructed Work and notify the Contract Administrator of any conditions, which prejudice the proper completion of this Work.

3.3 PRODUCT HANDLING

.1 Use all means necessary to protect the products included in this Division before, during and after installation, and to protect products and installed Work of all other trades.

.2 Any damage to the products and/or installed Work shall be repaired or replaced by the Contractor at no additional cost to the City and to the approval of the Contract Administrator.

.3 Remove advertising labels from all products installed that have such labels attached. Identification or CSA labels are not to be removed.

.4 Remove dirt, rubbish, grease, etc. resulting from Work performed under this Division of the Contract from all surfaces.

3.4 SEPARATION OF SERVICES

.1 Maintain separation between the electrical wiring system, piping, ductwork, and the instrumentation cables so that each system is isolated (except at approved connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is unacceptable.

.2 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings are not to be used for the support of wiring.

.3 Classifications of Circuits

.1 The circuit categorization shall of first priority follow Canadian Electrical Code with respect to separation for electrical safety and the following shall apply with respect to electro-magnetic compatibility:

Very Noisy	High voltage circuits and their associated grounding
	High current (>200 A) LV circuits.
	Harmonic-rich LV circuits
	DC circuits: un-suppressed or above 50 V
Noisy	Low current class two (2) circuits
	Medium power pulsed or radio frequency circuits
Indifferent	ELV digital status circuits
	Intrinsically safe circuits
	Telecommunications circuits
	Fire alarm and emergency lighting circuits (note that some fire alarm circuits may fall into the category of signal circuits).
	Any other emergency, shutdown, or high integrity circuit (e.g. toxic gas alarm).
Sensitive	Analogue signal circuits
	Data communication circuits
Very Sensitive	Low level voltage and current signals (e.g. from instrument sensors).

.4 Separation of Circuits

.1 This Section relates to the running of cables carrying differing types of circuit in close proximity to one another and to other services. Sensitive circuits shall normally be run in overall shielded cable. Very sensitive circuits shall normally be run in individually twisted pair shielded cable.

.2 For cables sharing the same support/containment system, the following shall provide guidance to minimize extraneous interference:

Segregation between circuits	**Very Noisy**	**Noisy**	**Indifferent**	**Sensitive**	**Very Sensitive**
Very Noisy	Thermal grouping as per CE Code	150 mm	300 mm	300 mm	300 mm
Noisy	150 mm	Thermal grouping as per CE Code	150 mm	150 mm	150 mm
Indifferent	300 mm	150 mm	Separation of circuit types.	100 mm	100 mm
Sensitive	300 mm	150 mm	100 mm	Touching	50 mm
Very Sensitive	300 mm	150 mm	100 mm	50 mm	Touching

3.5 WIRE AND CABLE

.1 Refer Division 26.

3.6 CONTROL WIRING COLOUR IDENTIFICATION

.1 Colour Codes

Conductor Purpose	Colour
Power, 120/208/240 VAC Supply	Black
Power, 120/208/240 VAC Neutral	White
Power, 24 VDC Supply (+)	Blue
Power, 24 VDC Common (-, or 0VDC)	Brown
Discrete Control AC	Red
Discrete Control DC	Blue
Intrinsically Safe	IS (light) Blue
Protective Earth (PE)	Green
Signal Ground/Instrumentation Earth (IE)	Green/Yellow

3.7 NETWORK CABLE – JACKET COLOUR

.1 Colour Codes

Cable Purpose	Colour
Ethernet, CAT5E or CAT6	Blue
Profibus DP	Purple
Profibus PA, Non-Intrinsically Safe	Black
Profibus PA, Intrinsically Safe	Light Blue
Modbus/RTU (serial)	Grey

3.8 EQUIPMENT CONNECTIONS

.1 Prior to the connection of signal wiring to process control and instrumentation devices, check the device voltage rating and polarity for compatibility with the corresponding loop and/or schematic diagram. Where device and circuit characteristics are found to be incompatible, the connections are not to be made. Report the condition immediately to the Contract Administrator.

.2 All control wiring diagrams illustrate typical control circuits applicable to the type of equipment specified. Control circuits may vary with different manufacturer's equipment. Verify all control circuits with the manufacturers of the equipment and make any corrections to the control wiring diagrams that may be required.

3.9 WIRING TO EQUIPMENT SUPPLIED BY OTHER DIVISIONS

.1 Equipment supplied by the City or by other Divisions, that have external or field mounted control devices, are to be installed, wired and commissioned by this Division.

3.10 INSTRUMENT MOUNTING STANDS

.1 Supply and install instrumentation mounting stands as required. Stands are to be either floor or wall mounted. The mounting stands are to be fabricated from aluminum.

.2 Supply and install protective drip shields for any exterior stand-mounted instrumentation equipment. Drip shields are to extend 50 mm past the front and side faces of the equipment. Drip shields are to be fabricated from aluminum.

3.11 SEALING OF WALL AND FLOOR OPENINGS

.1 Seal all conduit and cable entries passing through walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade.

.2 Seal openings after all wiring entries have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds that could chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations, if required, are to be sealed. Submit shop drawing for rated assembly prior to installation of fire stop.

3.12 TAGGING STANDARDS FOR DEVICES AND WIRING

.1 Tag all devices, wires, and I/O using the assigned loop, equipment, or device tag name. Where tag naming and numbering is not specified, the Contract Administrator will provide naming and numbering that is consistent with the plant naming conventions.

3.13 TESTING OF INSTRUMENTATION LOOPS

.1 After all devices within a loop have been connected, check the loop for correct functioning and interaction with other loops, where applicable. Provide written notice to the Contract Administrator when the loops are going to be tested so that the tests may be witnessed at the Contract Administrator’s discretion.

.2 Check the operation of final control elements such as solenoid valves, actuators, etc. by manual control before checking with automatic control.

.3 Check and simulate all alarms and shutdown functions.

.4 Test all tubing for leaks in compliance with ISA RP7.1. Isolate all instruments when tubing is being tested to protect against over pressure.

.5 Perform tests and record results on the test data forms that are included in this Section. Develop additional and/or more detailed test forms as necessary to suit more complex instrumentation.

.6 Sign and date all test reports. Submit the test reports to the Engineer within five Business Days of testing.

.7 Coordinate and cooperate with the City’s staff while they verify the instrument loop I/O in the programmable logic controller (PLC) and on the supervisory control and data acquisition (SCADA) system.

3.14 CALIBRATION

.1 Instruments are to be factory pre-calibrated. Verify calibration after installation for all instruments installed under these Specifications. Provide a printed record of the factory calibration parameters for "smart" devices.

.2 Prior to calibration, completely program all "smart" transmitters including entries of the appropriate range and tag number. Provide a printed record of smart device serial numbers against their assigned tag number with all programmed parameters.

.3 Calibrate all instruments to an accuracy of 0.5% of full range, or to the manufacturer's stated accuracy of the instrument whenever an accuracy of 0.5% is not achievable.

.4 Prior to instrument installation perform the following applicable calibration for each instrument and its associated signal conditioning equipment:

.1 Calibrate online analyzers with known samples.

3.15 COMMISSIONING

.1 Refer to the requirements of Division 1 for additional requirements.

.2 Inspections

.1 Provide two weeks' written notice to the Contract Administrator prior to energizing any system to allow for inspection by the Contract Administrator of the following:

.1 Proper mounting; and,

.2 Proper connections.

.2 During Commissioning, demonstrate to the Contract Administrator proper calibration and correct operation of instruments and gauges

.3 Commissioning of the instrumentation and control system to include, but not be limited to, the following.

.1 Verify installation of components, wiring connections and piping connections.

.2 Supervise wiring continuity and pipe leak tests.

.3 Verify instrument calibration and provide written report.

.4 Function check and adjust the instruments and control equipment under operational conditions.

.5 Coordinate manufacturer’s service personnel as required for complete system testing.

.6 Instruct plant personnel in correct method of instruments equipment operation.

.7 Direct plant personnel at hand-over as to final adjustment of the system for correct plant operation.

.8 Ensure that the Manufacturer’s representatives cooperate to complete the Work of this Section.

.9 Verify signal levels and wiring connections to all instrumentation and control equipment.

.10 Work with control system programmer to verify all field devices, wiring, calibration and operation.

3.16 TEST FORMS

Form No.	Title
.1 ITR	Instrument Test Report
.2 LCR	Loop Check Report

END OF SECTION

LOOP CHECK REPORT

☐ CHECKED OUT OK
☐ NOT APPLICABLE
☐ FURTHER ACTION REQUIRED

	INSTRUMENT TAG NO.								
LOOP NO. _____ SHEET NO. _____ P & I DWG. NO.									
INSTALLATION COMPLETE									
Primary Element									
Impulse Lines									
Block and Drain Valves									
Air Supply/Filter/Reg.									
Wiring									
Tracing/Insulation/Housing									
Mounting and Location									
PLC/SCADA I/O & Status									
CALIBRATED									
Impulse Lines Press. Tested									
LOOP CHECKED									
Element To Receiver									
X Mtr. to Receiver									
X Mtr./Trans. to Receiver									
X Mtr./Trans. to Switches									
Switches to Annunciator									
Interlocking Circuit									
Controller to Valve									
Controller Action D or R									

REMARKS:

READY FOR START-UP

DATE: _____

Installed by: _____

Checked by: _____

INSTRUMENT TEST REPORT

SYSTEM: _____

SERVICE: _____ TAG NO._____

LOCATION: _____ _____

MAKE: _____ MODEL: _____

SERIAL NO.: _____ CSA: _____

ELEMENT: _____ RANGE: _____

DESIGN SETTING/RANGE: _____ CONTACT TO: _____ ON: _____

SIGNAL IN:_____ OUT:_____ ASSOCIATED INSTRUMENT: _____

INSTRUMENT CONDITION: _____ CONFORM TO SPEC: _____

PROJECT NO.:_____ DATA SHEET: _____

	TEST 1				TEST 2			
TEST METHOD								
	INPUT		**OUTPUT**		**INPUT**		**OUTPUT**	
PROCESS	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**
TEST POINT 1								
TEST POINT 2								
TEST POINT 3								
TEST POINT 4								
TEST POINT 5								
COMMENTS								
GRAPHS								

TESTED BY: _____ CHECKED BY: _____

DATE: _____ DATE: _____

Part 1 General

1.1 REFERENCES - GENERAL

.1 Suppliers, Equipment, Products, and Execution must meet all requirements detailed in Section 29 05 00 – Common Work Instrumentation.

.2 Local control stations shall be supplied to house local control switches, push buttons and indicator lights associated with field devices (valves, drives etc.). The control stations shall be located in close proximity to their associated devices. Where a group of devices are located within close proximity to each other, the local controls may be combined into a single common local control panel. Line of site must be maintained between all devices and the respective local controls.

Part 2 Products

2.1 GENERAL

.1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey.

.2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

2.2 ENCLOSURES

.1 Provide Electrical EEMAC Type 12 enclosures for ordinary locations.

.2 Provide Electrical EEMA Type 4x enclosures for Category 1 and two (2) locations

2.3 WIRING AND ACCESSORIES

.1 Provide wiring inside the enclosures according to the following Specifications:

.1 Control wiring to be a minimum of #16 AWG tinned stranded copper; insulation rated at 600 V.

.2 Wiring for power distribution shall be a minimum of #14 AWG tinned stranded copper; insulation rated at 600 V.

.3 Install cables in accordance with the requirements of Division 26.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wireways such as Panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed 40% of the cross sectional area of the wire way.

.5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the enclosure. Identify each terminal strip with a terminal strip number, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding end device terminal number appended to it.

.2 Identify every joint and/or terminal of the above wire run with the same identifier until the wire meets another tagged device, at which point the wire identifier will change to use the new device name and terminal number.

.3 For example, pressure transmitter FIT-740 located in the field has a 1 PR-TPSH cable connected to it. The cable runs through a junction box to a marshaling panel. The wire identifiers for the pair of wires would be FIT-740 all the way to the marshaling panel.

.4 Identify spare wires by using the cable tag, wire number and an “-SP” suffix.

.5 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal blocks and all external wiring terminates on the outboard side.

.7 Provide sufficient terminals so that not more than two wires are connected under the same terminal. Provide 20% spare terminal capacity at each terminal block assembly.

.8 Terminals shall be Weidmuller W Series color coded as follows:

Red = positive 24 VDC
Black = analog signal plus
White = analog signal common and VAC neutral
Grey = 120 VAC
Green = ground

.9 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be white lamicoid with black lettering, a minimum of 25 mm x 75 mm in size with up to three lines of 5 mm lettering. Securely fasten nameplates in and situate them in a visible location.

2.4 PANEL GROUNDING

.1 Provide a ground system for the instrumentation circuits.

.2 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.

.3 Firmly bond all panel-mounted devices on or within the panels to ground. Provide supplementary bonding conductors for backpanels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

Part 3 Execution

3.1 MOUNTING HEIGHTS

.1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects 2000 mm to top of cover.

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

.1 Equipment, Products and Execution must meet all requirements detailed in Section 29 05 00 - Common Work Instrumentation.

Part 2 Products

2.1 MISCELLANEOUS PANEL DEVICES

.1 Ethernet Switch

.1 Install Ethernet switch in RTU control panel

.2 Eight (8) port unmanaged Ethernet switch

.3 Power Supply: 24 VDC

.4 Mounting: DIN rail

.5 Approved Product: Schneider Electric Connexium TCSEU083FN0

.2 Pilot Lights

.1 Provide LED transformer type pilot lights for extended lamp life, oil tight, push to test, complete with appropriate colour lenses. Normal colours used are run=red, stop=green, fault=amber. Refer to Division 26 for additional information.

.3 Terminals

.1 Provide strap screw type terminal blocks rated for 600 V.

.2 Identify each terminal block within an enclosure with a unique machine printed terminal block number. Cabinet chassis grounding terminal blocks to be identified by the electrical ground symbol.

.3 Connections to screw terminals to be locking fork tongue insulated crimp type wire connectors.

.4 Terminals to be Weidmuller or approved equal.

.5 Provide a group of terminals for each of 120 VAC hot and neutral and 24 VDC positive and negative power. Distribution wiring to have a thermal magnetic circuit breaker upstream of all major blocks of loads, adequately sized to protect the connected load while not causing nuisance tripping.

.6 Provide Weidmuller disconnect type terminal blocks for each load or loop powered from the marshalling panels.

.4 Nameplates

.1 Refer to Section 29 05 00 - Common Work Instrumentation.

Part 3 Execution

3.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00 - Common Work Instrumentation.

END OF SECTION

PLC I/O INDEX

RECORD NO.	REV. N0.	TAG NAME	DESCRIPTION FUNCTION	DESCRIPTION SERVICE	P&ID DRAWING	I/O SPECIFICATION ENG. UNITS	SCALE LOW	SCALE HIGH	ALARMS LOW	ALARMS HIGH	RTU CABINET	I/O TYPE	I/O ADDRESS	I/O EXPANSION CARD	I/O TERMINAL BLOCK	I/O POINT
0001	0	SW-810	Swtch	Test Operation Mode							RTU-80	DI	10001	0	P7	0
0002	0	LSH-L101	High Level Alarm	Wet Well	P-1					On	RTU-80	DI	10002	0	P7	1
0003	0	LSH-L531	High Level Alarm	Dry Well Flood	P-1					On	RTU-80	DI	10003	0	P7	2
0004	0		Spare								RTU-80	DI	10004	0	P7	3
0005	0		Spare								RTU-80	DI	10005	0	P7	4
0006	0		Spare								RTU-80	DI	10006	0	P7	5
0007	0		Spare								RTU-80	DI	10007	0	P7	6
0008	0	JA-820	Power Fail	120 VAC Power						On	RTU-80	DI	10008	0	P7	7
0009	0	JA-821	Power Fail	UPS 24 VDC Power						On	RTU-80	DI	10009	0	P8	8
0010	0	JI-822	Power OK	UPS 24 VDC Power Charging							RTU-80	DI	10010	0	P8	9
0011	0		Spare								RTU-80	DI	10011	0	P8	10
0012	0		Spare								RTU-80	DI	10012	0	P8	11
0013	0	SW-830	Panel door push button	Reset Modem and fail to locale							RTU-80	DI	10013	0	P8	12
0014	0		Spare								RTU-80	DI	10014	0	P8	13
0015	0	FA-L201	Fault	Magnetic Flow Meter	P-1					On	RTU-80	DI	10015	0	P8	14
0016	0		Spare								RTU-80	DI	10016	0	P8	15
0017	0		Spare								RTU-80	DI	10017	0	P9	16
0018	0	YC-L011.Run	Run Status	Discharge Pump P-L01	P-1						RTU-80	DI	10018	0	P9	17
0019	0		Spare								RTU-80	DI	10019	0	P9	18
0020	0	YC-L011.OL	Overload Fault	Discharge Pump P-L01	P-1					On	RTU-80	DI	10020	0	P9	19
0021	0	YC-L011.Auto	Hand - Off - Auto Switch	Discharge Pump P-L01	P-1						RTU-80	DI	10021	0	P9	20
0022	0	YC-L011.Hand	Hand - Off - Auto Switch	Discharge Pump P-L01	P-1						RTU-80	DI	10022	0	P9	21
0023	0		Spare								RTU-80	DI	10023	0	P9	22
0024	0		Spare								RTU-80	DI	10024	0	P9	23
0025	0		Spare								RTU-80	DI	10025	0	P10	24
0026	0	YC-L021.Run	Run Status	Discharge Pump P-L02	P-1						RTU-80	DI	10026	0	P10	25
0027	0		Spare								RTU-80	DI	10027	0	P10	26
0028	0	YC-L021.OL	Overload Fault	Discharge Pump P-L02	P-1					On	RTU-80	DI	10028	0	P10	27
0029	0	YC-L021.Auto	Hand - Off - Auto Switch	Discharge Pump P-L02	P-1						RTU-80	DI	10029	0	P10	28
0030	0	YC-L021.Hand	Hand - Off - Auto Switch	Discharge Pump P-L02	P-1						RTU-80	DI	10030	0	P10	29
0031	0		Spare								RTU-80	DI	10031	0	P10	30
0032	0		Spare								RTU-80	DI	10032	0	P10	31
0033	0		Spare								RTU-80	DI	10033	1	P7	0
0034	0	YC-L023.Run	Run Status	Discharge Pump P-L03	P-1						RTU-80	DI	10034	1	P7	1
0035	0		Spare								RTU-80	DI	10035	1	P7	2
0036	0	YC-L023.OL	Overload Fault	Discharge Pump P-L03	P-1					On	RTU-80	DI	10036	1	P7	3
0037	0	YC-L023.Auto	Hand - Off - Auto Switch	Discharge Pump P-L03	P-1						RTU-80	DI	10037	1	P7	4
0038	0	YC-L023.Hand	Hand - Off - Auto Switch	Discharge Pump P-L03	P-1						RTU-80	DI	10038	1	P7	5
0039	0		Spare								RTU-80	DI	10039	1	P7	6
0040	0		Spare								RTU-80	DI	10040	1	P7	7
0041	0		Hand - Off - Auto Switch in Auto	Automatic Transfer Switch						Off	RTU-80	DI	10041	1	P8	8
0042	0		Hand - Off - Auto Switch on Utility	Automatic Transfer Switch							RTU-80	DI	10042	1	P8	9
0043	0		Hand - Off - Auto Switch on Generator	Automatic Transfer Switch							RTU-80	DI	10043	1	P8	10
0044	0		Hand - Off - Auto Switch in Auto	Generator						Off	RTU-80	DI	10044	1	P8	11
0045	0		Run Status	Generator							RTU-80	DI	10045	1	P8	12
0046	0		Minor Fault	Generator							RTU-80	DI	10046	1	P8	13
0047	0		Major Fault	Generator							RTU-80	DI	10047	1	P8	14
0048	0		Spare								RTU-80	DI	10048	1	P8	15
0049	0	DC-L541, L542	Door Switch	Door Open						On	RTU-80	DI	10049	1	P9	16
0050	0	KS-L543	Key Switch	Building Security On/Off							RTU-80	DI	10050	1	P9	17
0051	0	PSL-L511	Pressure Switch	Compressed air	P-1					Low	RTU-80	DI	10051	1	P9	18
0052	0		Spare								RTU-80	DI	10052	1	P9	19
0053	0		Spare								RTU-80	DI	10053	1	P9	20
0054	0		Spare								RTU-80	DI	10054	1	P9	21
0055	0		Spare								RTU-80	DI	10055	1	P9	22
0056	0		Spare								RTU-80	DI	10056	1	P9	23
0057	0		Spare								RTU-80	DI	10057	1	P10	24
0058	0		Spare								RTU-80	DI	10058	1	P10	25
0059	0		Spare								RTU-80	DI	10059	1	P10	26
0060	0		Spare								RTU-80	DI	10060	1	P10	27
0061	0		Spare								RTU-80	DI	10061	1	P10	28
0062	0		Spare								RTU-80	DI	10062	1	P10	29
0063	0		Spare								RTU-80	DI	10063	1	P10	30
0064	0		Spare								RTU-80	DI	10064	1	P10	31
0065	0	FIT-L201.Pulse	FIT-L201	Flow Totalizer Pulse	P-1						RTU-80	DI	30012	0	P6	0
0066	0		Spare								RTU-80	DI	30014	0	P6	1
0067	0		Spare								RTU-80	DI	30016	0	P6	2
0068	0	P-L01.Start	Pump Start	Discharge Pump L01	P-1						RTU-80	DO	00001	0	P5	0
0069	0	P-L02.Start	Pump Start	Discharge Pump L02	P-1						RTU-80	DO	00002	0	P5	1
0070	0	P-L03.Start	Pump Start	Discharge Pump L03	P-1						RTU-80	DO	00003	0	P5	2
0071	0		Security System On/Off Light	Security System							RTU-80	DO	00004	0	P5	3
0072	0	YA-840	General Fault Alarm	General Fault							RTU-80	DO	00005	0	P5	4
0073	0	YI-850	RTU Mode Light	RTU Mode							RTU-80	DO	00006	0	P5	5
0074	0		Spare								RTU-80	DO	00007	0	P5	6
0075	0		Spare								RTU-80	DO	00008	0	P5	7
0076	0		Spare								RTU-80	DO	00009	0	P6	0
0077	0		Spare								RTU-80	DO	00010	0	P6	1
0078	0		Spare								RTU-80	DO	00011	0	P6	2
0079	0		Spare								RTU-80	DO	00012	0	P6	3
0080	0		Spare								RTU-80	DO	00013	0	P6	4
0081	0		Spare								RTU-80	DO	00014	0	P6	5
0082	0		Spare								RTU-80	DO	00015	0	P6	6
0083	0		Spare								RTU-80	DO	00016	0	P6	7
0084	0	LI-L111	Level Transmitter	Wet Well	P-1	mm	0	4000		>2130	RTU-80	AI	30001	1	P4	0
0085	0	LI-L112	Level Transmitter	Wet Well	P-1	mm	0	4000		>2130	RTU-80	AI	30002	1	P4	1
0086	0	FI-L201	Flow Transmitter	Pump station discharge	P-1	l/sec	0	150			RTU-80	AI	30003	1	P4	2
0087	0	TI-L551	Temperature Transmitter	Building Space	P-1	C	-10	40		<5	RTU-80	AI	30004	1	P4	3
0088	0		Spare								RTU-80	AI	30005	1	P4	4
0089	0		Spare								RTU-80	AI	30006	1	P4	5
0090	0		Spare								RTU-80	AI	30007	1	P4	6
0091	0		Spare								RTU-80	AI	30008	1	P4	7
0092	0		Spare								RTU-80	AO	40001	1	P3	0
0093	0		Spare								RTU-80	AO	40002	1	P3	1

Part 1 General

1.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00 Common Work Instrumentation.

1.2 RTU I/O INDEX

.1 The following spreadsheet gives an itemized list of the new Remote Terminal Unit (RUT) System inputs and outputs. It is intended to serve as an aid for determining the cabling requirements for the Work specified in this Division.

Part 2 Products

.1 Not used

Part 3 Execution

.1 Not used

END OF SECTION

Part 1 General

1.1 REFERENCES - GENERAL

.1 Refer to **Section 29 05 00 - Common Work Instrumentation**.

1.2 INSTRUMENT INDEX

.1 The following spreadsheet gives an itemized list of the instrumentation included as part of this Work.

Part 2 Products

.1 Not used

Part 3 Execution

.1 Not used

END OF SECTION

INSTRUMENTATION INDEX

RECORD NO.	REV. No.	LOOP NUM.	TAG NAME	DESCRIPTION		POWER SUPPLY	CALIBRATED RANGE	MOUNTING	SUPPLIED BY	INSTALLED BY	COMMENTS	SPEC. DATA SHEET	P&ID DRAWING
				INSTRUMENT TYPE	SERVICE								
0001	0	101	LSH-L101	Level Switch	Wet Well High Level	24 VDC		Suspended	Contractor	Contractor	Mounted at elevation 225m	I-016	P-1
0002	0	111	PIT-L111	Pressure Transmitter	Wet Well Level	Loop Powered	0 to 4000 mm	Wall	Contractor	Contractor		I-017	P-1
0003	0	112	PIT-L112	Pressure Transmitter	Wet Well Level	Loop Powered	0 to 4000 mm	Wall	Contractor	Contractor		I-017	P-1
0004	0	511	PSL-L511	Pressure Switch	Compressed Air	24 VDC		Pipe	Contractor	Contractor		I-105	P-1
0005	0	201	FE/FIT-L201	Flow Transmitter	Pump Station Discharge	Loop Powered	0 to 150 l/sec	Integral	Contractor	Contractor		I-101	P-1
0006	0	531	LSH-L531	Level Switch	Dry Well Flood	24 VDC		Suspended	Contractor	Contractor	Mounted 300 mm above floor	I-016	P-1
0007	0	541	DC-L541	Magnetic Door Switch	Main Entrance Door	24 VDC		Door Frame	Contractor	Contractor		I-103	P-1
0008	0	542	DC-L542	Magnetic Door Switch	Main Entrance Door	24 VDC		Door Frame	Contractor	Contractor		I-103	P-1
0009	0	543	KS-L543	Key Switch	Building Security	24 VDC		Box	Contractor	Contractor		I-104	P-1
0010	0	551	TIT-L551	Temperature Transmitter	Building Space	Loop Powered	-10 to 40 C	Wall	Contractor	Contractor		I-102	P-1

Part 1 General

1.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00 - Common Work - Instrumentation and Controls.

Part 2 Products

2.1 POWER SUPPLY AND CONDITIONING EQUIPMENT

.1 General

.1 Provide all DC power supplies as required for all instrument circuits. All circuits are to be powered from the PLC control panels. Power supplies to be Hammond, G.F.C., Weidmuller or approved equal, complete with an over-voltage protection module.

.2 DC power supplies shall be fully redundant. Individual fault signals from each power supply shall be monitored by the PLC for alarming.

.3 Unless otherwise required, all DC power supplies to be rated 28 VDC, adjustable plus or minus 5%, and set to provide 26.4 V on the panel direct current bus. Size the power supply for two (2) times the connected load, minimum size is 2 amps.

2.2 NOISE SUPPRESSION

.1 Provide TVSS units in each panel to power AC I&C loads. Power conditioners are to be SquareD, Cutler Hammer, Leviton.

Part 3 Execution

3.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00 - Common Work - Instrumentation and Controls, Part 3.

END OF SECTION

Part 1 General

1.1 REFERENCES – GENERAL

.1 Equipment, products, and execution must meet all requirements detailed in Section 29 05 00 - Common Work - Instrumentation and Controls.

1.2 GENERAL REQUIREMENTS

.1 Pumping station control system for facility

.1 The control system shall consist of the Remote Terminal Unity (RTU) and Operator Graphic Interface (OGI).

.2 The control system shall utilize an Ethernet backbone for communications between the RTU and OGI. The Ethernet backbone shall be CAT6 cabling.

.3 Contractor shall supply all software, hardware, and labour to provide a fully functional, and commissioned control system.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings for all hardware and software components.

Part 2 Products

2.1 OPERATOR GRAPHIC INTERFACE (OGI)

.1 The OGI shall be a 12.1”, 65536 colours, 800 x 600, TFT multi-touch resistive screen.

.2 Communications shall be Ethernet Modbus TCP/IP.

.3 OGI to be mounted in control panel.

.4 Operating System to be “Magelis”.

.5 Provide one (1) GB SD memory card.

.6 Approved product: Schneider Electric Magelis XBTGT6330 series.

2.2 CONFIGURATION

.1 Provide detailed graphic screens for the pumping station including:

.1 Wet well level

.2 Plant effluent flow rate and totalized flow

.3 Individual pump status, running, fault, in-auto

.4 Air compressor discharge pressure

.5 Power status: Generator, Automatic Transfer Switch.

.6 Building security

.7 Building temperature

.8 Building flood

.2 Provide trend screens for all input signals.

.3 Display all operational variables and equipment status.

.4 Configure alarm variables.

.5 Configure historical logging of all process variables onto SD memory card.

.6 Submit graphic layout screens and variable declarations as shop drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Configure IP address provided by the City.

.2 Verify all communications.

.3 Provide startup and commissioning services.

.4 Coordinate verification checks with others.

.5 Provide training to City's personnel.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Supply and install Remote Terminal Unit (RTU) based control panels for the pumping system, and building monitoring.

.1 Coordinate and cooperate with other Contractors, suppliers, and the City's Representatives during system programming, start-up, and commissioning of the complete control system and associated field devices and wiring.

.2 Provide complete RTU and operator graphic interface programming, start-up and commissioning.

Part 2 Products

2.1 REMOTE TERMINAL UNITS

.1 General

.1 Wall mounted NEMA 12 enclosures.

.2 Cable entry via bottom.

.3 Terminate all field wiring on terminal blocks in RTU control panels.

.4 Provide fused terminal blocks for all field power sourced from the control panel.

.2 RTU Processor

.1 Approved Product: Schneider Electric Scadapack 357E.

.3 RTU Expansion I/O Hardware

.1 Approved Product: Schneider Electric Scadapack E 5606.

.4 Power Supply

.1 Panel shall contain 24VDC power supply.

.2 Panel shall accept a single 120VAC, 15amp circuit.

.3 Panel door shall have a Green "Power On" light.

2.2 PROGRAMMING

.1 Document all programming logic.

.2 Provide the RTU programs and the operator interface program to the City after the completion of the commissioning.

Part 3 Execution

3.1 INSTALLATION

.1 Install the hardware in accordance with the foregoing requirements to satisfy the performance requirements defined in this and other Divisions of the Specification.

.2 Cooperate with other contractors, suppliers, the City and the Contract Administrator to commission and start-up the system as defined herein.

END OF SECTION

Part 1. General

1.1 REFERENCES - GENERAL

.1 The Work includes the provision of all instrument specification sheets.

.2 Refer to Section 29 05 00.

1.2 INSTRUMENT SPECIFICATION SHEETS

.1 Provide data sheets to itemize detailed as-built information regarding the Specification of instruments included as part of this Work for each instrument supplied. The data sheets already included in this Section list specific minimum requirements for particular applications.

.2 Use forms in accordance with the ISA Standard S20 as a template for the preparation of the specification sheets.

Part 2. Products

.1 Refer to the following specification sheets.

INSTRUMENT SPECIFICATION NUMBER:	**I-101**
DEVICE:	Flow Meter
TAG:	Refer to Instrument Index, **Section 29 40 21**
TYPE:	Magnetic Flow Meter
SERVICE:	Waste Water
SIZE AND MATERIAL:	**S**ize as per P&IDs
END CONNECTIONS:	Flanged
LINER MATERIAL:	PFA
ELECTRODES:	Stainless Steel
GROUNDING:	Stainless Steel grounding rings
RANGE:	Refer to Instrument Index, **Section 29 40 21**
INACCURACY:	±0.2% for flows greater than 0.3 m per second
OUTPUT:	4 to 20 mADC into 500 ohm load Scaled pulse output
POWER SUPPLY:	120 VAC, 60 Hz
INDICATION:	Local indication of flow rate and totalized flow
ELECTRONIC ENCLOSURE:	NEMA 4X. Integral transmitter. Remote wall-mount transmitter when flow tube is more than 1.5m AFF.
MANUFACTURER AND MODEL:	Rosemount 8700 Series ABB Magmaster Krohne Endress and Hauser.

INSTRUMENT
SPECIFICATION NUMBER: I-102

DEVICE:	Temperature
TAG:	Refer to Instrument Index, **Section 29 40 21**
SERVICE:	Space temperature
SPAN:	**-**10 to 40°C
SENSOR:	3 wire RTD, PT 100
INACCURACY:	±0.1% of span
OUTPUT:	4 to 20 mA DC into 500 OHM
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	Stainless steel wetted parts
ELECTRONIC ENCLOSURE:	Universal head, aluminum alloy
LOCAL DISPLAY:	Head mounted LCD Display
ACCESSORIES:	Mounting bracket
MANUFACTURER AND MODEL:	Rosemount

INSTRUMENT
SPECIFICATION NUMBER: I-103

DEVICE:	Magnetic Door Contact
TAG:	Refer to Instrument Index, **Section 29 40 21**
SERVICE:	Door position monitoring
SENSOR:	Reed Switch
OUTPUT:	N.O. Contacts, rated 0.5A, 30VDC
MOUNTING:	Recessed into door frame
CONSTRUCTION:	Designed for use in Steel Doors
MANUFACTURER AND MODEL:	GE Interlogix

INSTRUMENT
SPECIFICATION NUMBER: I-104

DEVICE:	Switch Lock
TAG:	Refer to Instrument Index, **Section 29 40 21**
SERVICE:	Alarm On/Off
OUTPUT:	Rated 7A at 125/250 VAC
POSITIONS:	Two maintained positions, key removable in both
MOUNTING:	Mount in Allen Bradley 800T enclosure
ACCESSORIES:	Complete with two LED indicator lamps, Green = alarm ON, Red = alarm Off
MANUFACTURER AND MODEL:	Medeco lock tumbler set

INSTRUMENT SPECIFICATION NUMBER:	**I-105**
DEVICE:	Pressure Switch
TAG:	Refer to Instrument Index, **Section 29 40 21**
SERVICE:	Refer to Instrument Index and P&ID Diagrams
PROCESS CONNECTION:	1/2 inch NPTF
SENSOR:	Brass Bellows
RANGE:	Refer to Instrument Index, **Section 29 40 21**
MOUNTING:	Bottom, Stem mounted
ENCLOSURE:	NEMA 4X
OUTPUT:	Form C Contacts rated 5 amps @ 120 VAC
MANUFACTURER AND MODEL:	Ashcroft United Electric Barksdale

INSTRUMENT SPECIFICATION NUMBER:	**I-106**
DEVICE:	Float Switch
TAG:	Refer to Instrument Index, **Section 29 40 21**
SERVICE:	Refer to Instrument Index and P&ID Diagrams
OUTPUT:	SPDT Contacts
ENCLOSURE:	Polypropylene float casing with pre-terminated signal cable
MOUNTING:	Provide strain relief-type connectors to suspend float at desired location. Fabricate mounting brackets from 316 SS. Provide anti-sway rings to prevent sway in turbulent tanks.
MANUFACTURER AND MODEL:	Flygt ENM-10 Consolidated Electric Warwick Magnetrol

INSTRUMENT SPECIFICATION NUMBER:	**I-107**
DEVICE:	Level Transmitter (Pressure measurement based)
TAG:	Refer to Instrument Index, **Section 29 40 21**
SERVICE:	Potable Water
PROCESS CONNECTIONS:	6 mm, ball valve
RANGE:	Refer to Instrument Index, **Section 29 40 21**
INACCURACY:	±1% of span or lower
OUTPUT:	4 to 20 mA DC into 500 OHM load
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	316 SST
ELECTRONIC ENCLOSURE:	EEMAC/NEMA 4X
LOCAL DISPLAY:	Unit mounted LCD Display
ACCESSORIES:	Block & bleed manifold
MANUFACTURER AND MODEL:	Rosemount ABB Endress and Hauser Or approved Equal

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies requirements for the supply of all materials, labour, process and equipment for the installation, testing and putting into satisfactory operation of all pumping station piping, fittings and appurtenances as shown on the drawings. Connections to all equipment are included.

.2 In-line devices are specified under other Sections of these Specifications. The physical installation of all these devices in the lines, including the supply of all jointing materials, couplings, etc., unless otherwise noted, is specified under this Section. These devices include, but are not limited to, the following:

.1 Gauges
.2 Flow metering devices
.3 Valves
.4 Analyzers.

.3 Process piping is all piping inside structure, above ground, exposed or underground to 0.5 m outside of structure.

.4 Pipes 50 mm and less may not be shown on the piping drawings. Line to be field routed with the approval of the Contract Administrator. The drawings designate the site and line service specifications of all pipes, fittings, valves and equipment to be supplied by the Contractor.

1.2 INSTALLATION OF PIPING, JOINTS, ETC.

.1 Install all piping, joints, fittings, valves and other items covered in this Section in accordance with the manufacturer's recommendations, except where there is conflict between the Contract Specifications and the manufacturer's recommendations, in which case the Contract Specifications shall govern.

.2 Contractor to submit welding procedures and copies of "Record of Qualifications" for each welder in accordance with ASME Code, Section IX and TSSA to the Contract Administrator. Welders shall be qualified for each separate material group.

1.3 PIPE LIST

.1 Pipe drawings specify pipe diameters, materials, service and accessories.

.2 Pipe drawings specify valves and inline devices.

.3 Piping drawings indicate routing of pipe and joint connections.

1.4 HANDLING AND STORAGE OF MATERIALS

.1 Assume complete responsibility for the safe delivery to the site of all pipe and fittings.

.2 Store pipe and fittings on timber platforms or in a manner approved by the Contract Administrator and protect by weatherproof housings.

.3 Inspect all fabricated material for damage in transit before installation in the work.

.4 Exercise particular care to avoid damage to internal and external coating on pipe and fittings. Repair damaged coating to the satisfaction of the Contract Administrator before installation.

.5 The Contract Administrator reserves the right to reject pipe and fittings that are damaged or defective.

1.5 FABRICATED ITEMS

.1 The Contractor shall assume full responsibility for detailed layout, co-ordination of system and field measurement for fabricated items.

1.6 PROJECT RECORD DOCUMENTS

.1 Maintain operating and maintenance data, including project record documents according to Section 01 78 00 – Closeout Submittals.

1.7 SUBMITTALS

.1 Produce Shop Drawings for Contract Administrator's review, as per Section 01 33 00. Details to include spool length, welds, unions, flange positions, and articulation or expansion joints.

.2 Contractor to produce pipe support drawing for all piping sealed by a Professional Engineer registered in Manitoba. Details to include location, size and type of supports. Pipe supports shown on drawings are a minimum requirement. All appropriate supports shall be detailed, supplied and installed by the Contractor.

1.8 MATERIAL CERTIFICATION

.1 At least ten business days prior to commencing work; submit manufacturer's test data and certification that pipe materials meet the requirements of this Section. Include manufacturer's Drawings, information and Shop Drawings where pertinent.

1.9 PIPE IDENTIFICATION

.1 Follow City of Winnipeg Standards for pipe identification.

Part 2 Products

2.1 PIPE AND FITTINGS

.1 This specification may include materials that are not required for the specific project or provide alternatives, which may be considered. The drawings take precedence for dictating piping for specific uses or applications unless otherwise indicated.

2.2 INTERIOR FINISHES

.1 Provide products with factory applied coatings and finishes unless otherwise noted.

.2 Do not shop coat the internal surface of stainless steel or plastic piping.

.3 Provide No. 1 or No. 2B standard finish for gauge stainless steel pipe, as specified in ASTM A480. Finish heavier pipe to No. 1 mill finish or better, as specified in ASTM A480.

2.3 EXTERIOR FINISHES – SHOP APPLIED

.1 Provide products with factory applied coatings and finishes as specified in the detailed pipe specification sheets.

2.4 STAINLESS STEEL PIPE (SS)

.1 Material: Type 304 stainless steel pipe and fittings.

.2 Pipe: to ASTM/A778 for diameter larger than 150 mm, and ASTM A 312, PE (plain end) for 150 mm diameter or less. Minimum wall thickness as follows:

.1 13 mm to 50 mm diameter: Schedule 40.

.2 75-300 mm diameter: Schedule 10.

.3 350-600 mm diameter: 3.18 mm (11 gauge).

.4 750-1200 mm diameter: 4.76 mm (7 gauge).

.3 Fittings: to ANSI B16.9 or MSS SP-43. Materials to conform to ASTM A 403. Smooth flow elbows shall be used where available from manufacturer. Larger elbows not manufactured in smooth flow type can be 5-piece section type.

.4 Joints:

.1 Maintenance: flanged, or groove coupling where necessary for ease of installation, disassembly and maintenance.

.2 Normal: buttweld.

.3 Instrument connections: threaded nipple.

.4 Expansion: flexible stainless steel couplings by Straub Flex 2, or approved equal.

.5 Fabricate stainless steel pipe systems as completely as possible in the shop to minimize connections by field welding.

.6 Welding materials, methods, operations and inspection shall be in accordance with current Provincial and Federal Regulations for welding of stainless steel. Use automatic welding techniques - Tungsten inert gas or metal inert gas method. Make circumferential welds using metallic arc process.

.7 Use welding rod or wire of the same composition or superior to the pipe and fittings material.

.8 Weld deposit at the seams shall have a slight crown on both sides of the weld. No cracks or crevices shall be allowed.

.9 Remove excessive weld deposits, slag, weld spatter and projections into the interior of the pipe by grinding.

.10 Secure all backing rings on spools to pipe flanges to prevent damage during shipment.

.11 Mark all spool items in the shop with Drawing and Item Numbers. Mark the type of stainless steel used.

.12 Flanges: Mild steel galvanized backing flanges drilled to ANSI B16.5 class 150# for all indoor locations. All other locations shall have 304SS flanges drilled to 150#. All flange connections on stainless steel pipes in tanks shall be 316 stainless steel flanges or 316 stainless Type B stud ends backing flanges with stainless steel bolts and nuts. Stainless steel grooved flanges and couplings installed in Sch 40 spool pieces are an approved alternate.

.13 Bolting: to latest edition of ANSI/AWWA C207 (ASTM A 307 Grade B, ANSI B18.2.1) for diameters 150 mm and larger or ASTM A 193/A 193M for smaller diameters. Corresponding nuts to be ASTM A 194/A 194M, Grade 2.

.14 Gaskets:

.1 Garlock 7797, or approved equal for flat faced flanges.

.2 Garlock Bluegard 3000 for raised face flanges.

.15 Fabricated stainless steel pipe to be as supplied by one of the following, or approved equal:

.1 Douglas Barwick Inc.

.2 The Robert Mitchell Company Ltd.

.3 Atlas Alloys.

.16 Provide reinforcing saddles (re-pad) at all pipe support locations of similar material, tack welded to pipe.

2.5 PIPE COUPLINGS

.1 As a general rule, Piping ≥100 mm will be flanged, welded or grooved to provide rigid connections of "ferrous" piping. Smaller piping will be typically welded or have threaded connections. Other piping materials such as the various forms of plastic, non-ferrous metals etc. will be joined as recommended by the manufacturer and/or to suit project conditions as required by Codes or good trade practice.

.2 Drawings will show where joints are required for serviceability. These will be required as a minimum. Because the Contractor will be allowed some flexibility on the type of material to be used, additional joints will be as required to suit the material e.g. welded steel piping vs. flanged ductile iron.

.3 Notwithstanding the previous comment, provide joints which may be disassembled within 1.0 m of any connection to equipment, on both sides of structural penetrations and within 0.6 m of all threaded end valves.

.4 Where noted on the Drawings to allow for serviceability or flexibility, the Contractor shall supply and install "Victaulic" or Smith-Blair flange adapter couplings. The Victaulic couplings shall be Style 31 (or as indicated) for grooved end fitting. Smith-Blair flange adapters shall be Type 912 up to 300 mm and 913 for pipes greater than 300 mm. Type 913 shall be hot dipped galvanized.

.5 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets (Uni-flange, etc.) except as approved by the Contract Administrator. They may be considered within a restrained run of pipe or where connections are made to existing pipe where there may be no other means to make the connection and as long as the joint can be restrained in other ways.

.6 Provide for other methods of connection to external pipes as detailed on the Drawings or as directed by the Contract Administrator.

2.6 CONCRETE

.1 Concrete for anchor blocks, thrust block and other pipe supports: to be Class I.

2.7 PIPE SUPPORTS AND HANGERS

.1 Refer also to Section 23 05 29 and attached detail sketch drawings (as applicable) of typical hanger details.

.2 Design hangers and supports to provide sufficient support to retain the piping system without exerting undo strain on the pipe, the attached equipment or the supporting structure. Design hangers and supports to the building code and ASME 31.3 at pipe pressure rating.

.3 The systems are to allow for pipe movement related to thermal expansion. Sagging or excessive movement from system operation is not acceptable.

.4 Provide details of the proposed support system sealed by a professional engineer to the Contract Administrator. The Contractor Administrator's review of the proposed support system does not relieve the Contractor from overall responsibility of the system integrity under design operating conditions. Supports may utilize fabricated steel components or poured-in-place reinforced concrete bases.

.5 Support systems are to allow for the partial dismantling of the piping system especially around equipment or fittings without having to provide supplementary supports. Specific supplementary supports of fittings such as valves are to be provided in addition to piping supports using the support provisions of the fitting.

.6 Provide piping supports, whether indicated on the Drawings or not, where necessary, to the satisfaction of the Contract Administrator. Hot-dip galvanize all piping supports after fabrication with galvanized fastenings as a minimum standard.

.7 Provide painting and protective coating according to Division 9. Exterior ferrous supports shall be hot-dipped galvanized, unless otherwise noted.

.8 Contractor to produce pipe support drawing for all piping sealed by a Professional Engineer registered in Manitoba. Details to include location, size and type of supports. Pipe supports shown on drawings are a minimum requirement. All appropriate supports shall be detailed, supplied and installed by the Contractor.

2.8 FITTINGS

.1 Fittings for piping systems to be compatible for the piping material and service.

.2 Provide fittings with a wall thickness equal to or greater than the pipe.

.3 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise. Provide concentric reducers in vertical lines unless indicated otherwise.

.4 Provide long radius elbows unless otherwise shown. Provide smooth flow carbon or stainless steel elbows 350 mm and less. Provide mitred elbows greater than 350 mm unless otherwise shown or specified.

2.9 EXPANSION JOINTS

.1 Design and fabricate expansion joints in accordance with EJMA standards.

.2 Provide expansion joints as shown and unless otherwise shown provide elastomer spool type expansion joints.

.3 Ensure corrugated type expansion joints are capable of a minimum 10,000 pressure, temperature and deflection cycles, not concurrent.

.4 For metal expansion joints of the metal bellows type, in systems handling gases, air, water or other liquids, provide liners to produce a smooth flow path, reduce vibration and reduce noise through the expansion joint.

.5 Provide sufficient bends and expansion joints to allow for thermal movement of piping from 0ºC to maximum service temperature.

.6 Provide factory pre-compressed expansion joints where required to suit installation temperature.

2.10 FLEXIBLE JOINT SPECIFICATION

.1 Flexible expansion and deflection joint shall be installed in the location shown on the Drawings.

.2 Material: Ductile iron to ANSI/AWWA C153/A21.53.

.3 Joint shall be able to expand and deflect simultaneously at least 100 mm expansion and 15º deflection.

.4 Acceptable products: "Ex-Tend 200" and "Flex-Tend", as manufactured by EBAA Iron Sales Inc. - 800-433-1716, with flanged restrained connection.

2.11 TAPPING FOR PRESSURE GAUGES OR INSTRUMENTS

.1 Provide 12 mm diameter stainless steel tapping with stainless steel ball valve for temporary pressure gauge connections both on suction and discharge side of pumps where specified.

.2 Provide a 12 mm diameter PVC tapping with PVC ball valve for temporary pressure gauge connection both on suction and discharge side of pumps where specified.

.3 Provide a tapping as described above compatible with pipe material for instrument connections or sampling points where shown complete with local isolation ball valve.

Part 3 EXECUTION

3.1 GENERAL PIPE INSTALLATION AND LAYOUT

.1 Contractor must verify all dimensions and new equipment locations in the field prior to the start of work. Install all piping and appurtenances to the dimensions indicated on the Drawings, square, straight, plumb and level.

.2 Carefully position pipe and fittings without strain or deflection and using proper appliances.

.3 Make due allowance for dimensional variation of equipment. Bring any dimensional discrepancies to the Contract Administrator's attention.

.4 The detailed layout of the piping, etc. is the responsibility of the Contractor. If required by the Contract Administrator, produce Field Drawings to show relative positions of various services, and receive Contract Administrator's approval before the work is started.

.5 Clear all foreign matter from inside piping and dispose of in accordance with proper environmental procedures

.6 For pressure piping 75 mm diameter and under, the Contractor may, subject to the Contract Administrator's prior approval, deviate locally from the layout indicated on the Drawings to suit local conditions and preserve proper headroom of 2.1 m minimum under all exposed pipes, unless otherwise noted.

.7 Where piping is not shown or is shown diagrammatically, install the pipes neatly to suit the structure, subject to the Contract Administrator's prior approval.

.8 Bolt piping to equipment before grouting piping into walls.

.9 Use appropriate bending tools (cold bending only) for copper pipe to produce smooth, even curves. Review and be familiar with all applicable codes pertaining to the works. The Contractor will be responsible to comply with all applicable Codes whether there has been a specific reference to the Code or not.

.10 Before commencing installation, determine specific piping support and thrust restraint requirements to suit the materials of construction, the piping materials and the operating conditions. Prepare and submit a detailed schedule of piping supports for the Contract Administrator's review.

.11 Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage.

.12 Install expansion joints where shown and at other locations as necessary to allow piping expansion and contraction.

3.2 PIPE CONNECTIONS TO EQUIPMENT, TANKS, ETC.

.1 The Contractor shall fully inform himself of the installation requirements and dimensions of equipment required to be connected to piping. Where piping is to tie into equipment, preliminary dimensions have been shown and are not guaranteed.

.2 Any change in such dimensions shall not relieve the Contractor of his responsibility to make the piping fit the equipment.

.3 Any fitting shown on the Drawings by a consistent symbol, but not described or scheduled, shall be incorporated into the work by the Contractor, who shall first determine from the Contract Administrator the requirements for such fitting.

.4 All connection fittings to tanks, equipment, etc. shall be such that the fittings may be easily removed from and replaced in the lines, or lines easily disconnected from equipment or tanks for maintenance purposes.

.5 Make connections compatible with that specified or shown on the Drawings for fittings, tanks or equipment, etc. or for intended service.

.6 In the event that the type of connection is not indicated on the Drawings or in the Specifications, use an approved flange, union or coupling.

.7 Unless otherwise shown or specified, install gauge taps on the suction and discharge of all pumps, fans, blowers, compressors and vacuum pumps. Attach gauge taps with a threaded nipple and valve to the pipeline, duct or equipment.

3.3 PIPE SUPPORTS, ANCHORS AND GUIDES

.1 Adequately support all piping, fittings and valves either from the floor on concrete piers or approved supports or from above with approved hangers.

.2 Design and place supports so that no weight will be taken directly on the equipment sleeve coupling or sleeves through walls, and will be satisfactory for the service intended.

.3 Adequately brace pipes and fittings cast into concrete floors, walls, etc. at each joint, to resist all buoyant or lateral forces imposed on the piping during concrete pours. Replace any piping or fittings found to yield from their intended position.

.4 Attach hangers to steelwork with approved clamps or welded tabs. Submit the proposed method of attaching pipe hangers to structural steelwork for approval.

.5 Attach hangers to concrete with approved threaded rod sockets cast into the concrete. Cinch anchor sockets may be permitted by the Contract Administrator in light duty service.

.6 Isolate supports and pipes of dissimilar materials using neoprene sheet or other approved material.

.7 Contractor to size and provide reinforcing saddles (re-pad) at all pipe support locations of similar material.

.8 Locate anchors and guides as shown on the Drawings and install elsewhere, as required by the piping systems. Design shall be adequate so that no stress is imposed on equipment and allowable stress in piping is not exceeded. Contractor to provide pipe support Drawings for Contract Administrator's review. Details to include location, size and type of supports.

3.4 PIPE JOINING

.1 Conform to requirements of ANSI B31 code for pressure piping.

.2 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.

.3 Install groups of piping parallel to each other, spaced to permit application of insulation, identification, and service access, on trapeze hangers.

.4 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets, i.e., with flat side up.

.5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.

.6 Install flanged or welded nozzles, branch connections, welding outlets, adapters and taps, true and faced at right angles to the axis of the pipe. Do not extend connection inside of pipe.

.7 Make pipe ends round and true, suitable for weld connection as applicable. Prepare pipe ends in accordance with ANSI B16.25 for butt welding.

.8 Copper pipe and tubing to be free from surface damage. Replace damaged pipe or tubing. Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked.

.9 Ream ends of pipe and tubes before being made up.

.10 Use non-corrosive lubricant or Teflon tape applied to male thread only.

.11 Groove pipe ends, cut square, seating surface clean and free from indent and score marks.

.12 Install dielectric fittings wherever piping of dissimilar metals are joined.

.13 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.

.14 Support piping during construction to prevent abnormal stresses on the pipe works.

.15 Do not weld adjacent to valves when the valve is in place to avoid heat damage to seats.

3.5 PIPE DRAINAGE

.1 At the low points in piping systems and at other locations indicated on the Drawings, install drains to permit draining any system without breaking a joint.

.2 Drains shall be 25 mm IPS for pipes larger than 50 mm diameter, and 13 mm IPS for pipes 50 mm diameter and under or as shown on drawings. Terminate drains 150 mm from the pipe in a valve suitable for the particular service and approved by the Contract Administrator. Plug or cap valves on the atmospheric side.

.3 Drain valves shall be accessible from the floor. Run drains to the collection point or provide quick disconnects at easily accessible locations.

3.6 CUTTING OF PIPE

.1 Whenever cutting of pipe is required, cut pipes as recommended by pipe manufacturer.

.2 Method of cutting and cutting equipment to be subject to the approval of the Contract Administrator.

3.7 PAINTING AND PROTECTIVE COATINGS

.1 Painting and protective coatings for pipe shall be in accordance with the foregoing and Division 9.

3.8 PIPE INSPECTION AND TESTING

.1 General:

.1 Provide all necessary equipment and perform all work required in connection with the tests.

.2 Bear the cost of all testing, location and remedying of leaks and any necessary retesting and alignment.

.3 All pipes shall be thoroughly flushed prior to pressure testing.

.4 All tests shall be documented on application forms provided by the Contract Administrator.

.2 Testing of pressure piping systems:

.1 Hydrostatically test all plant piping, other than non-pressure piping, in accordance with ANSI B31.1.0 at 1.5 times working pressure.

.2 All liquid and chemical carrying pipes shall be watertight under the test pressure and all suction piping shall be straight.

.3 Leave pipes uncovered in every part of the building until approved by the Contract Administrator.

.4 Should any leak develop in any of the pipes, repair the leaks or replace the defective Section at no cost to the City.

.5 Continue repairs and testing until the leakage has been stopped.

.6 Extend each test over a period of at least two hours, unless a short period complies with ANSI B31.1.0.

.3 X-ray inspection of welds:

.1 Piping welding shall be X-rayed at the discretion of the Contract Administrator. If the Contract Administrator is not satisfied with the welding or suspects pin holes in the weld, he will request the welds be X-rayed. The percentage to be tested depends on the workmanship and quality of the welding being done.

.2 Cost of X-ray inspection shall be borne by the City. Re-inspection will be paid by the Contractor.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section refers to the supply, delivery, and testing of the following valves:

.1 Dry Pit Location:
.2 Three (3) 200 mm Iron Gate Valves – manually actuated
.3 Three (3) 150 mm Iron Gate Valves – manually actuated
.4 Three (3) 150 mm Process Check Valves
.5 Wet Well Location:
.6 One (1) 400 mm Iron Gate Valve – manually actuated

.2 Supply all other materials, products, and services described in this specification.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 30 00 – Submittal Procedures.

1.3 REFERENCES

.1 American Water Works Association (AWWA), American National Standards Institute (ANSI) / American society of Mechanical Engineers (ASME).

.2 ASNI/ASME Bl.20.1, Pipe Threads, General Purpose (Inch).

1.4 PRODUCT DATA

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

.2 Submit data for all valves specified in this section.

1.5 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.6 EXTRA MATERIALS

.1 Furnish following spare parts:

.1 Valve seats: one for every ten (10) valves each size. Minimum 1.
.2 Stem packing: one (1) for every ten (10) valves, each size. Minimum 1.
.3 Valve handles: two (2) of each size. If only one handle of certain size is supplied, provide one spare only. Do not provide spare chain wheels.
.4 Gaskets for flanges: one for every ten (10) flanged joints. Minimum 1.

Part 2 Products

2.1 VALVE OPERATORS

.1 Supply valve operators or actuators for all types of valves specified as follows:

.1 Dry Pit Valves: Supply hand wheels.

.2 Wet Well Valve: Valve stem extension complete with 50 x 50 square AWWA operating nut.

.3 Ensure that each valve and operator is of suitable construction and rating for the long term service with the fluid or product being conveyed and at the pressure and operating frequencies required by the relevant service.

.4 The allowable pull on a manual operator to open or close the valve shall be ≤270 N (60 lb force). Manual operators shall operate in a clockwise motion to close the valve. Provide gate valves ≥ 400 mm diameter with a 50 mm manual by-pass valve arrangement to allow for the relief of excess pressure.

.5 Supply cast iron hand wheels clearly marked with a flow directional arrow and the word "open" cast in relief on the rim. Provide hand wheels >300 mm in diameter for all valves > 200 mm and 450 mm in diameter for larger valves as required to allow for manual operation. In confined areas, furnish smaller hand wheels with higher ratio gearing of the valve to compensate.

.6 Supply steel pipe Tee wrenches with socket to suit nut dimensions. In cases of valves in tanks requiring extension stems and Tee wrenches, the wrench shall be secured in place.

2.2 GENERAL VALVE REQUIREMENTS

.1 Where there is an applicable recommended standard for the design, construction, and testing of a valve and/or actuator, e.g., AWWA, CGA, CSA etc., equipment to be supplied under this section will refer to this standard. Comply with these requirements for all equipment supplied in all regards. Where specifically requested, provide certificates of compliance with the applicable standards.

.2 Where it is not intended to supply equipment or valves to a specific standard, the specification will indicate a reference product. Provide flanges as specified for all flanged valves for the line into which they are to be installed. As a minimum standard a Class 125 lb rating will be required.

.3 All packing, gaskets, seats, diaphragms, lubricants, etc., shall be suitable for the intended operating conditions.

2.3 IRON GATE VALVE SPECIFICATION

.1 Cast iron body with flanged ends; outside screw and yoke; bronze stem, double O-ring stem seals.

.2 Bronze trimmed cast iron wedge

.3 Stem:

.1 Dry Well Gate Valves: Rising stem type.

.2 Wet Well Gate Valve: Non-rising stem type.

.4 End connections: flanged to ANSI B16.1, Class 125.

.5 Packing and gaskets: non-asbestos.

.6 Fusion bonded epoxy coating on the interior and exterior including gland cover, body, and bonnet to AWWA C-550.

.7 All fasteners, nuts, and bolts shall be stainless steel.

.8 Direction of opening shall be counter clockwise and shall be clearly stamped or indicated with raised letters and arrow.

.9 Manufacturer's nameplate shall be attached to the valve body with stainless steel fasteners.

.10 Acceptable manufacturers provided they meet the above specifications:

.1 Crane
.2 Toyo Valve
.3 Jenkins Figure
.4 Milwaukee
.5 Clow (McAvity)
.6 Mueller
.7 American AVK or R/D

2.4 PROCESS CHECK VALVES

.1 Ductile iron body with flanged ends and removable inspection cover manufactured and tested in accordance with AWWA C508.

.2 End connections: flanged to ANSI B16.1, Class 125.

.3 ASTM D2000-BG, Buna-N (NBR) sewage resistant rubber flap and Type 302 stainless steel disc accelerator.

.4 Manufacturer's nameplate shall be attached to the valve body with stainless steel fasteners.

.5 Acceptable manufacturers provided they meet the above specifications:

.1 Val-Matic Series 500
.2 Flomatic

Part 3 Execution

3.1 GENERAL

.1 Supply all necessary labour and tools for the complete installation of all valves.

.2 Install all valves in strict accordance with the manufacturer's instructions and as specified.

3.2 INSTALLING VALVES

.1 Construct foundations for valves (as applicable) in accordance with Division 3 and as directed by the Contract Administrator. Temporarily support the equipment as may be required. All temporary supports shall be rigid and so constructed as not to subject the equipment to any undue stresses or cause any damage.

.2 Properly align the valves and adjacent piping with the stem truly vertical unless otherwise shown and flange bolts carefully tightened to prevent overstressing or distortion of the valve flanges or body.

3.3 HANDLING OF VALVES

.1 Do not place chains, cables and ropes through valve ports or attached to operating cylinders or hand wheels. Use slings either around the valve body or with bolts or rods through the flange bolt holes.

.2 Store valves in a cool location clear of moving vehicles or other objects. Dirt and debris shall be prevented from entering the valve internals. Do not rest valves on cylinders, hand wheels or operating shafts.

.3 Cover valves to shield them from dirt and to avoid exposing the seats to sunlight or mercury arc light.

3.4 SHOP TESTING

.1 Test AWWA valves at the manufacture’s facility in accordance with AWWA requirements. A certified test report shall be submitted.

3.5 CERTIFICATES

.1 On completion of installation and testing, submit the manufacturer's certification of the correctness of the installation to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies the supply, delivery, testing, and commissioning of centrifugal vertical shaft pumps.

.2 Pumping equipment shall include motors, drives, anchor bolts, base plates, supporting frame, and all appurtenances required for an operating system.

.3 Co-ordinate with Division 26.

1.2 GUARANTEES

.1 In addition to the requirements of other Divisions, equipment shall be guaranteed to perform to the specified operating conditions.

1.3 REFERENCE STANDARDS

.1 Pumping units shall generally comply with the requirements of the Hydraulic Institute Standards.

.2 Pumping unit wiring shall conform to Division 26.

.3 Pumping unit shall be CSA approved.

1.4 SHOP PAINTING

.1 All equipment is to be painted with manufacturer's standard coatings.

1.5 STANDARDS

.1 Have equipment comply with the latest edition of the applicable codes and regulations including, but not limited to, the following:

.1 American Society of Mechanical Engineers (ASME)

.2 Canadian Standards Association (CSA)

.3 Canadian Electrical Manufacturers Association (CEMA)

.4 National Electrical Manufacturer's Association (NEMA)

.5 American Society for Testing and Materials (ASTM)

.6 American National Standard Institute (ANSI)

.7 Electrical Electronics Manufacturing Association of Canada (EEMAC).

.8 Electrical Safety Association (ESA).

.2 Have all electrical equipment comply in every respect with the rules and regulations of Manitoba Hydro and be acceptable to their local inspector.

.3 In cases of any conflict between these specifications and any of the above standards, the most stringent standard will have precedence.

1.6 SUBMITTALS

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

.2 Shop drawings shall include details of the equipment stand, complete with instructions for attachment of the stand to the concrete base.

.3 Performance curves shall be submitted with the shop drawings. Performance curves shall include capacity, head, pump efficiency, BkW, and NPSH from shut-off through the rated point to run-out.

.4 Submit operation and maintenance manuals in accordance with Section 01 78 00 – Closeout Submittals.

.5 Attached Data Sheets must be completed and submitted as part of the shop drawings.

Part 2 Products

2.1 CENTRIFUGAL PUMPS

.1 General:

.1 Supply and three (3) close coupled centrifugal vertical shaft pumps as detailed in this specification

.2 The pump shall be supplied complete with:

.1 Motor

.2 Base (4 legged)

.3 Flanged suction and discharge piping connections

.4 Drives

.5 Couplings

.2 Operating requirements:

.1 Pump shall be sufficient to provide 38 L/s of flow at 7.4 m total head.

.2 Pump head/capacity curves shall be continuously rising toward shut-off.

.3 Select pump so that rated pump capacity point lies on the left-hand side of the best efficiency point on the pump curve.

.4 The required net positive suction head (NPSHR) shall not exceed the available NPSH at any point on the curve and cavitation-free performance shall be guaranteed.

.5 Motor shall be sized so that the pump is non-overloading throughout the pump performance curve from shut-off to run-out conditions.

.3 Mechanical requirements:

.1 Pumps to be 4” non-clog type, especially designed for use of mechanical seals

.2 Casing shall be rated for 1.5 times working pressure.

.3 Bearings:

.1 The upper bearing shall be free to move linearly with the thermal expansion of the shaft and shall carry only radial loads.

.2 Lower bearing (nearest to impeller) shall be adequate to carry all radial and axial thrusts developed by largest impeller that bowl can accommodate.

.3 Shaft bearing nearest the pump impeller shall be locked in place so that shaft end play is limited to the clearance within the bearing.

.4 A bearing cap shall be provided to hold the bottom motor bearing in a fixed position. Bearing housings shall be provided with fittings for lubrication as well as purging old lubricant.

.5 Shaft and sleeve:

.1 Shaft and shaft sleeve shall be designed for minimum deflection at maximum load. Shaft assembly shall be one (1) piece, ground and polished. Shaft sleeve shall be renewable, positively driven by impeller key.

.2 The shaft from the top of the impeller to the lower bearing supporting the impeller shall have a minimum diameter of 1 7/8”. The dimension from the lowest bearing to the top of the impeller shall not exceed 6”.

.3 Removable shaft sleeves will not be acceptable if the shaft under the sleeve does not meet the specified minimum diameter. O-ring shall be provided to prevent leakage under shaft sleeve.

.4 Shaft material shall be 316SS.

.5 Shaft runout limited to .003”.

.6 Seals:

.1 The pump shaft shall be sealed against leakage by a double mechanical seal installed in a bronze seal housing constructed in two (2) sections with registered fit.

.2 The seal housing shall be recessed into the pump backhead and securely fastened thereto with stainless steel cap screws.

.3 The inside of the seal housing shall be tapered to facilitate the replacement of the seal parts.

.4 Seals material to be carbon ceramic with the mating surfaces lapped to a flatness tolerance of one (1) light band. The rotating ceramics shall be held in mating position with the stationary carbons by a stainless steel spring.

.5 The seal housing with assembled parts shall be so constructed as to be readily removable from the shaft as a unit and shall be provided with tapped jackscrew openings to assist in removing it from the backhead.

.6 The seal shall be pressurized and lubricated buy liquid taken directly from the pump backhead through a filter to the seal housing and introduced between the upper and lower sealing surfaces, the filter shall be of corrosion-resistant materials and shall screen out all solids larger than 50 microns. The seal

system shall contain a brass valve connected near the top of the seal housing to permit the relief of any trapped air.

.7 Construction:

.1 The motor shall be attached to the pump volute by a one (1)-piece cast-iron adapter and backhead.

.2 The pump shall be arranged so that the rotating element can easily be removed from the volute without disconnecting the electrical wiring or disassembling the, impeller, backhead, or seal.

.3 The pump volute shall be free from projections that might cause clogging or interfere with flow through the pump.

.4 The motor shall be fitted with heavy lifting eyes or lugs, each capable of supporting the entire weight of the motor and pump.

.8 Motor:

.1 The motor shall be vertical solid shaft, Nema P-base, squirrel-cage induction type, suitable for 3 phase, 60 cycle, 575 volt electric current.

.2 Insulation: Class F

.3 NEMA Design: Class B

.4 Open drip proof with forced air circulation by integral fan. Openings for ventilation shall be uniformly spaced around the motor frame. Leads shall be terminated in cast connection box and shall be clearly identified.

.9 Impeller:

.1 Pump impeller to be enclosed two (2)-port type made of close-grained cast-iron and shall be balanced.

.2 3” solids handling capacity

.3 Impeller to be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device and shall be readily removable without the use of special tools.

.4 Impeller to Shaft Fit: Tapered

.5 Impeller Shroud: Untrimmed – Full Diameter

.10 Provide 12 mm (1/2") tappings for suction and discharge pressure gauges on pump casing.

2.2 EQUIPMENT MOUNTING

.1 Pump and motor shall be supported by a heavy cast-iron base with four (4) legs. The height of the base shall be sufficient to permit the use of an increasing suction elbow, which shall be provided when the nominal pump size is smaller than the suction line. The suction and discharge openings shall be flanged faced and drilled 125-pound American Standard.

.2 The pump must be secured to base at the factory or in the field, with bolts and/or dowels such that the motor-pump shaft shall be centered, in relation to the motor base within .005”.

.3 Provide list of recommended spare parts for City's follow-up.

2.3 SPARE PARTS

.1 Provide list of recommended spare parts for City's follow-up.

2.4 ACCEPTABLE PRODUCTS

.1 The pump shall be Smith and Loveless model 4B2 or approved equal.

Part 3 Execution

3.1 PUMP TESTING

.1 Each manufacturer shall guarantee his pump(s) for the rated capacity and overall efficiency when installed and operating under the specified conditions of head and discharge.

.2 Submit results of factory performance tests to the Contract Administrator as Certified Pump Test Curves including capacity, head, pump efficiency, BkW and NPSH from shut-off through the rated point to run-out.

.3 Conduct factory performance tests in accordance with the Hydraulic Institute Standards.

3.2 LUBRICATION, GREASE, OIL AND FUEL

.1 Perform the complete initial lubrication of all equipment in accordance with the manufacturer's instructions. Provide all grease, oil, lubricants, etc., as required for the initial operation of the equipment.

3.3 SUPERVISION OF INSTALLATION

.1 All equipment and material shall be installed in a workmanlike manner, in accordance with the manufacturer’s recommendations.

.2 Supplier to provide installation instructions, in accordance with the manufacturer’s requirements, including details for anchor bolts, frames and other items to be cast into concrete work, prior to the installation of the Equipment.

.3 A copy of the installation manual shall be attached to every machine package.

.4 The Contractor shall install the equipment where shown on the Drawings and in strict accordance with the manufacturer’s instructions and in compliance with applicable local, provincial and federal codes and regulations.

.5 Supplier to provide appurtenances, fittings, connecting piping, framing, accessories and anchor bolts not herein or elsewhere specifically mentioned or included, but necessary for the operation of the equipment package.

.6 The Contractor shall provide concrete and grout, final piping and electrical connections and other appurtenances not herein or elsewhere specifically mentioned or included, but necessary for the installation, operation and testing of the equipment, without additional payment.

.7 All possible precautions should be taken to ensure proper alignment of equipment shafts and pipe connections to avoid transmission of piping weight reactions to the equipment at pipe connections or equipment damage due to misalignment.

.8 The manufacturer shall provide a competent representative to supervise the installation of the equipment and materials.

.9 After the equipment has been installed and prior to final acceptance, protect the equipment from damage. Ensure that protection measures are to the satisfaction of the Contract Administrator.

.10 Co-ordinate the placement of all cast-in anchor bolts with Division 3.

.11 Set anchor bolts for equipment at least 150 mm into the concrete base.

.12 Comply with requirements of Hydraulic Institute Standards for installation of all pumps.

.13 The manufacturer shall provide a Certificate of Installation in accordance with to the Contract Administrator when the equipment has been satisfactorily installed.

.14 Before acceptance of the equipment by the City, it shall be inspected and final adjustments made by a qualified, competent representative of the manufacturer.

.15 The manufacturer shall provide a Certificate of Installation to the Contract Administrator when the equipment has been satisfactorily installed in accordance with Section 01 33 00.

3.4 COMMISSIONING

.1 Provide two (2) weeks' notice to the Contract Administrator prior to commencement of commissioning to witness the activities.

.2 The Equipment Manufacturer's Technical Representative or approved alternate shall inspect the pump installation to ensure that the equipment has been installed in accordance with the manufacturer's requirements. If the installation is not in order, Equipment Manufacturer's Technical Representative shall provide instruction for the installation Contractor. The equipment shall be started and run, and adjustments made at this time.

.3 The Manufacturer's Technical Representative, installation Contractor and Contract Administrator shall jointly commission the works in accordance with the written procedure for commissioning. The installation Contractor shall provide sufficient manpower for the duration of the commissioning period. The installation Contractor shall make necessary adjustments during commissioning to put the works into continuous operation.

.1 The Contract Administrator will request that the equipment be operated to demonstrate that it performs as specified. If the Contract Administrator notes deficiencies, the deficiency shall be corrected immediately by the installation Contractor. The installation Contractor

shall advise the Contract Administrator, in writing, when the deficiencies have been corrected.

.2 Deficiencies of a serious nature, as determined by the Contract Administrator, shall be corrected by the Manufacturer's Representative.

1.1 PUMP TESTING

.1 Each manufacturer shall guarantee his pump(s) for the rated capacity and overall efficiency when installed and operating under the specified conditions of head and discharge.

.2 Conduct field testing by operating the single pump for approximately 30 minutes (when system conditions permit) and readings taken of head, flow, power and speed. Capacities shall be with ±5% of the design point at rated head as measured by the system flow meter. The acceptance of the pump units will be based on the achievement of test results satisfactory to the Contract Administrator. If the efficiencies of the pump or drive are more than 3% below that guaranteed, the City reserves the right to reject the equipment, or repairs shall be made to make the equipment performance satisfactory to the City.

3.5 TRAINING

.1 Commissioning and training shall be combined. Training sessions shall be documented and include the following as a minimum:

.1 Functional description of equipment operation.

.2 Identification of components and their purpose.

.3 Confirmation of operating parameters and machine limits.

.4 Review of routine maintenance procedures and maintenance supplies.

.5 Trouble shooting procedures, limits of operator, and maintenance competence.

.6 Long-term maintenance procedures, including anticipated overhaul frequencies

.2 No additional payment will be made by the City to an equipment supplier for the training. Cost to be included in the lump sum for the specific equipment.

.3 Provide demonstration and operation and maintenance training for equipment in accordance with Section 01 79 00

END OF SECTION

Part 1 GENERAL

1.1 DESCRIPTION

.1 This Section specifies the requirements for the temporary diversion of wastewater during construction and commissioning of the pump station. The wastewater being diverted is raw un-screened sewage.

1.2 SUBMITTALS

.1 Submit schedule for shut-down or closure of pump station and commencement of wastewater diversion operations. Adhere to schedule and provide notice to all affected parties.

Part 2 Products

2.1 PUMPS AND APPURTENANCES

.1 Duty pump to provide 76 L/s at 7.4 m total head.

.2 Stand-by pump(s) to provide 76 L/s at 7.4 m total head.

.3 All piping, flexible hoses, plugs, alarms, back-up generator and related appurtenances required to provide diversion of wastewater from the pump station as indicated on Drawing C-1.

2.2 PUMPS CONTROLS

.1 Control system complete with float switches for automatic level control and manual start/stop ability.

.2 Temporarily connect existing RTU control panel to new pump controls to monitor a high level alarm and loss of utility power.

2.3 BACKUP POWER

.1 Provide portable generator to provide backup power in the event of a utility failure. Switching to generator and back to utility shall be a manual transfer switch.

Part 3 Execution

3.1 TEMPORARY WASTEWATER DIVERSION

.1 The Contractor shall be responsible for providing temporary wastewater diversion from the pump station such that the community experiences no interruptions to its wastewater service.

.2 Wastewater shall be diverted from the pump station as indicated on Drawing C-1.

.3 The Contractor is to supply a high level alarm and a power failure alarm at MH 'A' indicated on Drawing C-1. The alarms shall be connected to the existing RTU panel and will be monitored by City staff. The contractor will be notified if an alarm is triggered.

.4 The Contractor shall provide a back-up generator complete with manual transfer switch on site for the continued pumping of wastewater in the event of a utility power failure.

.5 A duty pump and a stand-by pump shall be used for the diversion of wastewater from the pump station. If the existing manhole cannot accommodate a duty pump and stand-by pump concurrently, a stand-by pump will be available at the site should the duty pump fail at any time throughout the construction period. Apparatus for changing out pumps will be available on site throughout the construction period.

.6 Temporary pumping system will be remotely monitored by the City. The Contractor shall be available 24 hours per day, seven (7) days per week to respond to site in the event of a pumping system alarm. Contractor may have to change pumps, start generator or perform other corrective action to maintain pumping.

.7 The Contractor shall be responsible for any direct and indirect loss or damage which may be incurred due to the failure of the Contractor to provide adequate wastewater diversion from commencement of construction to completion of commissioning.

END OF SECTION