


Public Works and Government Services
Canada



New Victoria Mine Water Treatment Plant New Fluid Cooler

Issued for Tender

New Victoria Mine Water Treatment Plant New Fluid Cooler

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1.1 DESCRIPTION OF WORK .1

Supply and install one new fluid cooler at the New Victoria Water Treatment Plant, New Victoria, NS. In general, work under the contract to include but not limited to:

- .1 Supply and install new geothermal piping runs (insulation by Departmental Representative). Connect to existing geothermal supply and return loop piping in approximate location of existing heat exchangers, and pipe out to new fluid cooler outside of building.
- .2 Supply and install new fluid cooler.
- .3 Excavate, supply and install new reinforced concrete pad for new fluid cooler, and pipe supports.
- .4 Contractor to ensure all work is scheduled and coordinated with water treatment plant's limited shutdowns. The treatment plant must be operational before and after the scheduled shutdowns.
- .5 Supply and install new automatic glycol fill system and associated propylene glycol.
- .6 Supply and install new control wiring, sensors and modify existing building management system. (i.e., graphics, programming, sequences, etc.).
- .7 Electrical power wiring to new fluid cooler is to be supplied and installed by Departmental Representative. Contractor to make final field connection to new fluid cooler.
- .8 Due to other projects ongoing at this site, cooperate with other project contractors in carrying out their respective work and carry out all instructions from Department Representative in this regard.

- .2 Site of Work is located at: New Victoria Water Treatment Plant, 15 Browns Road Extension, New Victoria, Nova Scotia, B1H 4Y6.

1.2 FAMILIARIZATION WITH SITE .1

Before submitting a bid, it is recommended that bidders visit the site to review and verify the form, nature and extent of work, materials needed, the means of access and the temporary facilities required to perform the Work.

1.3 CODES AND STANDARDS .1

Perform work in accordance with the 2015 National Building Code of Canada and any other code of provincial or local application, including all amendments up to bid closing date, provided that in any case of conflict or discrepancy, the more stringent requirement shall apply.

1.3 CODES AND
STANDARDS
(Cont'd)

- .2 Materials and workmanship must meet or exceed requirements of specified standards, codes and referenced documents.

1.4 SETTING OUT
WORK

- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as straight edges and templates required to facilitate Departmental Representative's inspection of work.
- .4 Supply stakes and other survey markers required for laying out work.

1.5 DOCUMENTS
REQUIRED

- .1 Maintain at job site, one copy each of the following:
- .1 Contract Drawings
 - .2 Specifications
 - .3 Addenda
 - .4 Reviewed Shop Drawings
 - .5 List of outstanding shop drawings
 - .6 Change Orders
 - .7 Other modifications to Contract
 - .8 Field Test Reports
 - .9 Copy of Approved Work Schedule
 - .10 Health and Safety Plan and other safety related documents
 - .11 Other documents as stipulated elsewhere in the Contract Documents.

1.6 PERMITS

- .1 In accordance with the the General Conditions, obtain and pay for building permit, certificates, licenses and other permits as required by municipal, provincial and federal authorities.
- .2 Provide appropriate notifications of project to municipal and provincial inspection authorities.
- .3 Obtain compliance certificates as prescribed by legislative and regulatory provisions of municipal, provincial and federal authorities as applicable to the performance of work.
-

- 1.6 PERMITS (Cont'd)
- .4 Submit to Departmental Representative, copy of application forms and approval documents received from above referenced authorities.
 - .5 Contractor to obtain all required site permits from Departmental Representative prior to commencing work (i.e. hot work, confined space, etc.).
- 1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING
- .1 Execute work with least possible interference or disturbance to building operations occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
 - .2 Where security has been reduced by work of Contract, provide temporary means to maintain security.
 - .3 Provide temporary dust screens, barriers, warning signs in locations where renovation and alteration work is adjacent to areas which will be operative during such work.
- 1.8 ROUGHING-IN
- .1 Be responsible for obtaining manufacturer's literature and for correct roughing-in and hook-up of equipment.
- 1.9 CUTTING, FITTING AND PATCHING
- .1 Ensure that cutting and patching required by all trades is included in total bid price submitted for the work.
 - .2 Execute cutting, including excavation, fitting and patching required to make work fit properly.
 - .3 Where new work connects with existing and where existing work is altered, cut, patch and make good to existing work. This includes patching of openings in existing work resulting from removal of existing services.
 - .4 Do not cut, bore, or sleeve load-bearing members, except where specifically approved by Departmental Representative.
 - .5 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
 - .6 Fit work airtight to pipes, sleeves ducts and conduits.
-

1.9 CUTTING,
FITTING AND
PATCHING
(Cont'd)

- .7 All work to be approved by Departmental Representative.

1.10 CONCEALMENT

- .1 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except in process areas.

1.11 LOCATION OF
EQUIPMENT

- .1 Location of equipment, shown or specified shall be considered as approximate. Actual location shall be as required to suit conditions at time of installation and as is reasonable.
- .2 Locate equipment, devices and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative when impending installation conflicts with other new or existing components. Follow directives for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.12 EXISTING
SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to pedestrian, vehicular traffic and plant operations.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit schedule and obtain approval from Departmental Representative to coordinate with scheduled 2 week shut-down. This includes disconnection of electrical power and communication services to operational areas. Adhere to approved schedule and provide notice to affected parties.
- .4 Provide temporary services when directed by Departmental Representative to maintain critical building systems.
-

1.12 EXISTING
SERVICES
(Cont'd)

- .5 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .6 Where unknown services are encountered, immediately stop work and advise Departmental Representative and confirm findings in writing.
- .7 Protect, relocate or maintain existing active services as required. When inactive services are encountered, immediately notify Departmental Representative and cap off in manner approved by authorities having jurisdiction over service. Record locations of maintained, re-routed and abandoned service lines.

1.13 BUILDING
SMOKING
ENVIRONMENT

- .1 Comply with smoking restrictions.
 - .1 Smoking is prohibited.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 45 00 - Quality Control.
 - .2 Section 31 23 33 - Excavation, Trenching and Backfilling.
 - .3 Section 03 30 00 - Cast in Place Concrete and Miscellaneous Equipment.
- 1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE
- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various sections.
- 1.3 APPOINTMENT AND PAYMENT
- .1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
 - .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
- 1.4 CONTRACTOR'S RESPONSIBILITIES
- .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests and provide full cooperation to the testing agency for collection of samples.
 - .3 Make good Work disturbed by inspection and test.

PART 1 - GENERAL

- 1.1 SUBMITTALS .1 Upon acceptance of bid and prior to commencement of work, submit to Departmental Representative the following work management documents:
- .1 Work Schedule as specified herein.
 - .2 Shop Drawings Submittal Schedule.
 - .3 Waste Management Plan.
 - .4 Environmental Plan.
 - .5 Health and Safety Plan.
 - .6 Hot Work Procedures.
 - .7 Lockout Procedures.
 - .8 Dust Control Plan.
 - .9 List of workers requiring security clearance and those to be placed on Site Security Control list as specified.
 - .10 Project cost breakdown.
- 1.2 PRECEDENCE .1 For Federal Government projects, Division 1 Sections take precedence over technical specifications sections in other Divisions of this Project Manual.
- 1.3 DEFINITIONS .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
 - .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
 - .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
 - .5 Duration: number of work periods (not including holidays or other nonworking periods) required to
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1.3 DEFINITIONS
(Cont'd)

- .5 Duration: (Cont'd)
complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.4 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.5 SUBMITTALS

- .1 Submit to Departmental Representative within 7 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
 - .2 Submit Project Schedule to Departmental Representative within 5 working days.
-

1.6 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 3 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline updates.

1.7 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Mobilization.
 - .3 Placement of traffic control barriers.
 - .4 Excavation of concrete pad location, installation of new pad.
 - .5 Preparing wall penetrations.
 - .6 Installation of new fluid cooler, controls, glycol fill, pipe supports and associated piping system.
 - .7 Tie ins to existing systems as required.
 - .8 Testing of new piping system.
 - .9 Insulation of piping.
 - .10 Commissioning of system and associated controls.
 - .11 Reinstatement of grass and gravel areas back to grades.
 - .12 Site cleanup.
 - .13 Substantial completion.

Note: Contractor to ensure all work is scheduled and coordinated within the Mine Water Treatment Plant's limited 2 week shutdown. The treatment plant must be operational after the scheduled 2 week shutdown.

1.8 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on a weekly basis reflecting activity changes and completions, as well as activities in progress.
 - .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current
-

- 1.8 PROJECT SCHEDULE REPORTING (Cont'd) .2 (Cont'd) forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
- 1.9 PROJECT MEETINGS .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.
- 1.10 OPERATIONAL RESTRICTIONS .1 The Contractor must recognize that building occupants will be affected by implementation of this contract. The Contractor must perform the work with utmost regard to the safety and convenience of building occupants and users. All work activities must be planned and scheduled with this in mind. The Contractor will not be permitted to disturb any portion of the building without providing temporary facilities as necessary to ensure safe and direct passage through disturbed or otherwise affected areas.
- .2 Contractor to meet with the Departmental Representative on a daily basis to identify intended work areas, activities and scheduling for the coming week.
- .3 The Water Treatment Plant operates 24 hours a day, 7 days a week except for limited shutdowns. Shutdowns of any systems that impact operations of the Plant must be scheduled and approved by the Departmental Representative two weeks in advance so that notices to staff can be circulated. Schedules must be updated weekly. Contractors' schedules will be circulated to security and Departmental Representative when approved as notice of work anticipated for the following week. To assure that construction work may proceed productively without risk to safety of building occupants, and due to the nature of the operation be aware that certain work of this contract must be carried out.
- .4 Off Hours: means a period of time which is outside the daily operational hours of the the Facility.
-

1.10 OPERATIONAL
RESTRICTIONS
(Cont'd)

- .5 Departmental Representative reserves the right to stop certain daytime work activities, if the nature of that activity generates excessive noise or dust and have Contractor re-schedule that particular work to be performed during the Off-Hour period.
 - .6 Ensure that all trades are aware of the "Off-Hour" requirements of this contract and ensure that any extra costs incurred as a result is included in the Contractor's bid price for the work. No extra cost will be paid due to failure by General Contractor or his sub-contractors to recognize the off-hour requirements and other restrictions specified herein and to include all necessary allowances within their bids.
 - .7 See Specification in Regards to:
 - .1 Special security requirements which must be observed in the course of the work.
 - .2 Provision of security personnel by Contractor as part of the Work.
 - .8 Facility Circulation Maintained:
 - .1 Ensure that entrances, corridors, stairwells, fire exits and other circulation routes are maintained free and clear providing safe and uninterrupted passage for Facility users at all times during the entire work.
 - .2 Maintain those areas clean and free of construction materials and equipment. Provide temporary dust barriers and other suitable enclosures to ensure users are not exposed to construction activities and are protected from exposure to dust, noise and hazardous conditions.
 - .3 Maintain fire escape routes accessible and fire fighting access open all times for the duration of the project.
 - .4 Do not under any circumstances block fire exit doors. Do not leave construction materials or debris in corridors, stairwells, building entrances and exits.
 - .9 Safety Signage:
 - .1 Provide on site, and erect as required during progress of work, proper bilingual signage, mounted on self-supporting stands, warning the public and building occupants of construction activities in progress and alerting need to exercise caution in proceeding through disturbed areas of the facility, and directing building occupants through any detours which may be required.
 - .2 Signage to be professionally printed and mounted on wooden backing, coloured and to express
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1.10 OPERATIONAL
RESTRICTIONS
(Cont'd)

- .9 Safety Signage:(Cont'd)
 - .2 (Cont'd)
messages as directed by the Departmental Representative.
 - .3 Generally maximum size of sign should be in the order of 1.0 square meters. Number of signs required will be dependent on number of areas in facility under renovation at any one time.
 - .4 Include cost for the supply and installation of these signs in the bid price.

 - .10 Dust and Dirt Control:
 - .1 See Sections 01 52 00 - Construction Facilities and 01 74 11 - Cleaning for dust control and cleaning requirements.
 - .2 Effectively plan and implement dust control measures and cleaning activities as an integral part of all construction activities. Review all measures with the Departmental Representative before undertaking work, especially for major dust generating activities.
 - .3 Do not allow demolition debris and construction waste to accumulate on site and contribute to the propagation of dust.
 - .4 As work progresses, maintain construction areas in a tidy condition at all times. Remove gross dust accumulations by cleaning and vacuuming immediately following the completion of any major dust generating activity.
 - .5 Immediately remove all debris and dust from within occupied areas as generated by work therein during a given work shift.
 - .6 Avoid situations and practices which results in dust and dirt being brought from the construction areas or from the exterior and tracked inside the building into occupied areas used by tenants and the public.
 - .7 Stop workers with soiled footwear from entering building. This includes roofing mechanics and heavy civil workers.
 - .8 Inform workers and make them sensitive to the need for dust and dirt control. Stringently enforce rules and regulations, immediately address non-compliance.
 - .9 Keep access doors to work areas closed at all times. Use only designated doors for entry or egress.

 - .11 Work in Occupied Areas:
 - .1 Where work must be carried out in an occupied area beyond the boundaries of the enclosed construction site, perform such work during the non-operational off-hour periods of the Facility.
 - .2 Ensure that all dust, dirt, debris, construction waste, materials, tools and equipment
-

1.10 OPERATIONAL
RESTRICTIONS
(Cont'd)

- .11 Work in Occupied Areas: (Cont'd)
- .2 (Cont'd)
are completely removed at the end of each "off-hour"
work shift. Clean and reinstate area ready for
daytime use by tenant.
 - .3 Provide temporary dust barriers around
immediate work areas and place fabric drop sheets
over workstations, equipment and other furnishings
located immediately adjacent to such work.
 - .4 Conduct work in such a way as to minimize the
creation of dust and to avoid contaminating areas
beyond the immediate location.
 - .5 Discuss and obtain Departmental
Representative's approval before hand on the type and
extent of dust barriers, protective devices and
measures needed.
 - .6 Be responsible for temporarily moving office
furnishings, workstations, computer equipment and
other objects as needed to gain access and conduct
work. Reinstall all dislocated items at end of each
workshift making the area operational again.
 - .7 Disconnect and reconnect any power and
communications systems feeding workstations as
required.
 - .8 Clean such areas as well as those corridors and
routes used to gain entry and access.
- .12 Cleaning of Occupied Areas used by Contractor:
- .1 Clean lobbies, corridors, stairs and other
circulation routes used by workers to gain access to
work by conducting cleaning, vacuuming and washing of
floors, walls and other soiled surfaces.
 - .2 Meager attempts at controlling dust and
ineffective unprofessional cleaning procedures will
not be tolerated.
 - .3 Failure to provide effective dust control,
allowing construction dust and dirt to escape beyond
construction areas and contaminate occupied areas and
building circulation areas will result in Contractor
being ordered to immediately provide professional
cleaning services without delay to remedy the
situation and conduct all cleaning to the extent as
determined by Departmental Representative.
Alternatively, Departmental Representative may, at
certain times and at own discretion, obtain the
services of an independent building cleaning agency
when cleaning being provided by Contractor is
ineffective or tardy in response. Costs of such
services will be charged against Contractor in the
form of financial penalties or holdback assessments
against the Contract.
- .13 Ensure that all sub-trades are made aware of and
abide by the contents of this section and in
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1.11 WORK
COORDINATION
(Cont'd)

- .4 Work Cooperation:(Cont'd)
 - .2 (Cont'd)
the work and in such a way as to prevent unnecessary delays, cutting, patching and the need to remove and replace completed work.

- .5 No extra costs to the Contract will be considered by the Departmental Representative as a result of Contractor's failure to effectively coordinate all portions of the Work. Disputes between the various trades as a result of their not being informed of the areas and extent of interface work shall be the sole responsibility of the General Contractor to be resolved at own cost.

1.12 OTHER
CONTRACTS

- .1 There is currently one other scheduled contract that could be in progress at the site during the course of this work at this time.

- .2 Further contracts may be let during the period that this contract is in progress.

- .3 Cooperate with other Contractors in carrying out their respective works and carry out all instructions from the Departmental Representative in this regard.

- .4 Connect properly and coordinate work with that of other Contractors, if required. If any part of the work under this Contract depends for its proper execution or result upon the work of another Contractor, report promptly to the Departmental Representative, in writing, any defects or schedule issues in the work of such other Contractors as it may interfere with the progress of this work.

1.1 RELATED
SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTAL
GENERAL REQUIREMENTS

- .1 Submit to Departmental Representative for review requested submittals specified in various sections of the specifications including shop drawings, samples, permits, compliance certificates, test reports, work management plans and other data required as part of the work.
 - .2 Submit with reasonable promptness and in orderly sequence so as to allow for Departmental Representative's review and not cause delay in Work. Failure to submit in ample time will not be considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.
 - .3 Do not proceed with work until relevant submissions have been reviewed.
 - .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
 - .5 Where items or information is not produced in SI Metric units, provide soft converted values.
 - .6 Review submittals prior to submission. Ensure that necessary requirements have been determined and verified and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
 - .1 Submittals not stamped, signed, dated and identified as to specific project will be returned unexamined by Departmental Representative and considered rejected.
 - .7 Verify field measurements and affected adjacent Work are coordinated.
 - .8 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
-

1.2 SUBMITTAL
GENERAL REQUIREMENTS
(Cont'd)

- .9 Contractor's responsibility for errors, omissions or deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
 - .10 Submittal format as per Departmental Representative requirements, including shop Drawings, Submittals, schedules, record drawings, commissioning reports, etc. Non-legible submittals or facsimiles will not be accepted and be returned for resubmission. Electronic submittals are to be in Portable Document Format (PDF). Each submission is to be issued as a separate file. PDF submittals to be generated at a suitable scanned resolution so that it can be read easily and interpreted without ambiguity. Optimize the file size to allow for reasonable electronic transmission while maintaining clarity at the drawing.
 - .11 Make changes or revision to submissions which Departmental Representative may require, consistent with Contract Documents and resubmit as directed by Departmental Representative.
When resubmitting, identify in writing of any revisions other than those requested.
 - .12 Keep one reviewed copy of each submittal document on site for duration of Work.
- 1.3 SHOP DRAWINGS AND PRODUCT DATA
- .1 The term "shop drawings" means fabrication drawings, diagrams, illustrations, schedules, performance charts, drawings, erection technical product data, brochures, specifications, test reports installation instructions and other data which are to be provided by Contractor to illustrate compliance with specified materials and details of a portion of work.
 - .2 Shop Drawing Quantities:
 - .1 Ensure sufficient hard copies are printed to enable one complete set to be included in each of the maintenance manuals specified in 01 78 00 - Closeout Submittals.
-

1.3 SHOP DRAWINGS .3
AND PRODUCT DATA
(Cont'd)

Shop Drawings Format:

.1 Opaque white scans of drawings, in PDF of original drawings or standard drawings to clearly illustrate work specific to project requirements. Maximum sheet size to be 1000 x 707 mm. PDF to be scanned at a resolution so that it can be easily interpreted.

.2 Product Data from manufacturer's standard catalogue sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products, to be original full colour brochures, clearly marked indicating applicable data and deleting information not applicable to project. Scans are acceptable.

.3 Non or poorly legible drawings, files, scans, photocopies or facsimiles will not be accepted and returned not reviewed.

.4 Shop Drawings Content:

.1 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where items or equipment attach or connect to other items or equipment, confirm that all interrelated work has been coordinated, regardless of section or trade from which the adjacent work is being supplied and installed.

.2 Supplement manufacturer's standard drawings and literature with additional information to provide details applicable to project.

.3 Delete information not applicable to project on all submittals.

.4 Equipment installation/start-up data: include manufacturer's recommended installation instructions, pre-start and start-up checklists for those pieces of equipment and systems designated to be commissioned.

.5 Allow 14 calendar days for Departmental Representative's review of each submission.

.6 Adjustments or corrections made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, advise Departmental Representative in writing prior to proceeding with Work.

- 1.3 SHOP DRAWINGS .7 If upon review by Departmental Representative,
AND PRODUCT DATA no errors or omissions discovered
(Cont'd) or if only minor corrections and comments are
made, fabrication and installation may proceed
upon receipt of shop drawings.
If shop drawings are rejected and noted to be
Resubmitted, do not proceed with that portion of
work until resubmission and review of
corrected shop drawings, through same submission
procedures indicated above.
- .8 Accompany each submission with transmittal
letter, in duplicate, containing:
- .1 Date.
 - .2 Project title and project number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop
drawing, product data and sample.
 - .5 Other pertinent data.
- .9 Submissions shall include:
- .1 Date and revision dates.
 - .2 Project title and project number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's
authorized Representative certifying approval of
submissions, verification of field measurements
and compliance with Contract Documents.
 - .5 Cross references to particular details of
contract drawings and specifications section
number for which shop drawing
submission addresses.
 - .6 Details of appropriate portions of Work as
applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions,
including identified field
dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
-

- 1.3 SHOP DRAWINGS AND PRODUCT DATA
(Cont'd)
- .10 Submissions shall include:(Cont'd)
- .6 (Cont'd)
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
 - .11 After Departmental Representative's review, distribute copies.
 - .12 The review of shop drawings by the Departmental Representative or designate is for sole purpose of ascertaining conformance with general concept. This review shall not mean that the Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of the construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.
- 1.4 SAMPLES
- .1 Submit for review samples as specified in respective specification Sections. Label samples with origin and intended use.
 - .2 Deliver samples to Departmental Representative's office or to other address as directed. Do not drop off samples at construction site except for pre-approved circumstances previously approved by Departmental Representative.
 - .3 Notify Departmental Representative 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.
-

1.4 SAMPLES
(Cont'd)

- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments will result in a cost increase to the Contract notify Departmental Representative in writing prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative 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.

PART 1 - GENERAL

1.1 GENERAL

- .1 The Contractor will perform all the work activities in accordance with the applicable occupational health and safety legislation.
- .2 Health and safety considerations required to ensure that PWGSC shows due diligence towards health and safety on construction sites, and meets the requirements laid out in PWGSC/RPB Departmental Policy DP 073 - Occupational Health and Safety Construction.

1.2 REFERENCES

- .1 Province of Nova Scotia, Occupational Health and Safety Act.
- .2 The National Building Code of Canada, Part 8, Safety Measures at Construction and Demolition Sites
- .3 CSA S350-M1980 (Reaffirmed 2003), Code of Practice for Safety in Demolition of Structures.
- .4 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .5 Health Canada/Workplace Hazardous Materials Information system (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit a site-specific Assignment Health and Safety Plan within seven (7) working days of project award. Mobilization to the site is not to occur without written acceptance by the Departmental Representative of the submitted Plan. The Health and Safety Plan must include:
 - .1 Results of a site specific safety assessment of the hazards anticipated to be encountered.
 - .2 The corrective actions to be implemented

by the Contractor to mitigate the hazards identified.

.3 Roles and responsibilities of on-site personnel specific to health and safety.

.4 Details of the Contractors emergency response plan.

.5 Details of Personal Protective Equipment to be used. Note: mandatory PPE to include: CSA approved hard hat, CSA approved safety eyewear, CSA approved safety footwear and retro-reflective clothing.

.6 Provision for supervision of employees by a competent person.

.7 Provisions for training of employees.

.8 Identification of critical or hazardous tasks.

.9 Provisions for regular workplace inspections.

.10 Provisions for incident reporting and investigations.

.11 Provisions for safety meetings.

- .3 Submit one copy of Contractor's authorized representative's work site health and safety inspection reports to the Departmental Representative on daily basis.
- .4 Submit to the Departmental Representative copies of reports or directions issued by Provincial health and safety officers within 24 hours.
- .5 Submit copies of incident reports to the Departmental Representative within 24 hours of occurrence.
- .6 The Contractor shall comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding training, use, handling, labeling, storage and disposal of hazardous materials. and submit WHMIS MSDS - Material Safety Data Sheets for all controlled products taken to the site by the Contractor.
- .7 The Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. The Contractor will revise the plan as deemed appropriate and resubmit plan to the Departmental Representative within 3 days after receipt of comments from Departmental Representative.

- .8 The Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 The Departmental Representative makes no representation and provides no warranty for the accuracy, completeness and legislative compliance of the Health and Safety Plan.
- .10 The Contractor's responsibility for errors and omissions in the Health and Safety Plan is not relieved by review of Health and Safety Plan by Departmental Representative.

1.4 FILING OF
NOTICE

- .1 The Contractor is responsible to file any necessary "Notice of Project" with the applicable provincial and municipal authorities prior to beginning of Work. Permits required by the above parties will be obtained at the Contractor's cost.

1.5 SAFETY
ASSESSMENT

- .1 Upon arriving on the site, prior to conducting work activities, the Contractor is to perform a site specific hazard assessment of the actual hazards related to project. This assessment must be submitted to the Departmental Representative within 24 hours of completion.

1.6 MEETINGS

- .1 The Contractor will schedule and administer a Health and Safety meeting with the Departmental Representative prior to commencement of Work.
- .2 The Contractor is to conduct an orientation meeting with employees assigned to the site, outlining the site specific health and safety issues. Document this meeting and submit documentation to the Departmental Representative within 24 hours of occurrence.
- .3 The Contractor is to conduct daily safety briefings (toolbox talks) with their employees. Such meetings will be documented and made available to the Departmental Representative upon

request.

1.7 REGULATORY
COMPLIANCE

- .1 Comply with the requirements contained in the Nova Scotia Occupational Health and Safety Act, and all regulations pursuant to the Act.
- .2 The Contractor will comply with the requirements of the Federal and Provincial Transportation of Dangerous Goods (TDG) Act and Regulations.

1.8 GENERAL
REQUIREMENTS

- .1 The Contractor shall implement a method of site control that adequately defines their work zone and prevents unauthorized access.
- .2 The Departmental Representative will implement a system for incident reporting and investigations. The following events require mandatory reporting to the Departmental Representative within 24 hours of occurrence:
 - .1 Work related fatality.
 - .2 Injury or illness requiring first aid or medical attention.
 - .3 Fire, explosion or electrical flash.
 - .4 Property damage in excess of \$1000.
 - .5 Incidents resulting in, or that could result in an investigation by a regulatory agency.
 - .6 Near misses.
- .3 The Contractor will provide the Departmental Representative with all documents requested to support regulatory compliance within 24 hours of the request being made.

1.9 RESPONSIBILITY

- .1 The Contractor will be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by ongoing Work.
- .2 The Contractor will comply with and enforce compliance by employees with the safety requirements of Contract Documents, applicable regulations, ordinances, and with site-specific Health and Safety Plan.

- .3 The Contractor shall develop site specific rules designed to aid in worker and public protection and implement a disciplinary process designed to correct employee behavior where safety infractions have occurred.

1.10 UNFORSEEN
HAZARDS

- .1 When an unforeseen or peculiar safety-related factor, hazard, or condition occurs during performance of Work, the Contractor will stop Work and reassess the work method to ensure the safety and health of their employees. Where unforeseen hazards occur, the Departmental Representative will have the right to request the Contractor review and potentially amend their submitted health and safety Plan to address unforeseen hazards.

1.11 HEALTH AND
SAFETY COORDINATOR

- .1 The Contractor will employ and assign to the work site a competent and authorized representative as Health and Safety Coordinator. The Health and Safety Coordinator must:
 - .1 Have working knowledge of occupational safety and health regulations and the site related work being conducted.
 - .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .4 Be on site during execution of Work. Note: The Health and Safety Coordinator may perform other functions, provided such functions shall not interfere with that of health and safety requirements.

1.12 POSTING OF
DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province of Nova Scotia and in consultation with Departmental Representative.

1.13 CORRECTION OF
NON-COMPLIANCE

- .1 The Contractor will immediately address health and safety non-compliance issues identified by authority having jurisdiction or by the Departmental Representative.
- .2 The Contractor will provide the Departmental Representative with a written report of action taken to correct non-compliance of health and safety issues within 24 hours of notice of the non-compliance.
- .3 The Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.
- .4 Periodic reviews of the Contractor's work may be carried out by the Departmental Representative to monitor the Contractor's compliance with the implementation of the Health and Safety Program. Inspections will include visual inspections as well as testing and sampling that may be required to ensure the highest possible level of health and safety at the site. The Departmental Representative shall have the right to:
 - .1 Demand a higher level of safety if, in the opinion of the Departmental Representative, it is deemed necessary.
 - .2 Issue a stop work order immediately for any work which is considered, in the opinion of the Departmental Representative, to be an immediate danger to life and health (IDLH) or of imminent risk to the environment.
 - .3 The Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.14 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.15 POWDER
ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from the Departmental Representative.

1.16 WORK STOPPAGE

.1

The Contractor will give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 45 00 - Quality Control.
 - .2 Section 31 23 33 - Excavation, Trenching and Backfilling.
- 1.2 REFERENCES
- .1 Canadian Council of Ministers of the Environment (CCME)I Environmental Quality Guidelines.
 - .2 Nova Scotia Department of Environment and Labour, Air Quality Regulations, Section 1.3 of the Environment Act.
 - .3 Nova Scotia Department of Environment and Labour, Erosion and Sedimentation Control Handbook for Construction Sites
 - .4 Environment Canada, Section 36(3) of the Fisheries Act, prohibits the planned or accidental discharge of deleterious substances to waters frequented by fish.
 - .5 Environment Canada, Migratory Birds Convention Act, prohibits the deposit of oil, oil wastes, or other substances harmful to migratory birds or in any area frequented by birds.
 - .6 Environment Canada, The Federal Policy on Wetland Conservation.
- 1.3 ENVIRONMENTAL PROTECTION PLAN
- .1 Prepare in writing a site specific Environmental Protection Plan in order to clearly define environmental protection measures. The plan must expand on the use of materials, products, procedures, and application techniques that respond to and have effects on the environment and contingency plans to deal with environmental problems that may arise due to the work.
 - .2 The Environmental Protection Plan must incorporate any activities to be undertaken by sub-contractors if any are employed in the process. The Environmental Protection Plan must, at a minimum address the following elements:
 - .1 Introduction
 - .2 Mandate
-

- 1.3 ENVIRONMENTAL PROTECTION PLAN (Cont'd)
- .2 (Cont'd)
 - .3 Goals and Objective
 - .4 Roles and Responsibilities
 - .5 Project Description
 - .6 Mitigation Procedures
 - .7 Emergency and Contingency Plans
 - .8 Key Contact List
 - .3 As sub-sections to the Mitigation Procedures there will be the following:
 - .1 Petroleum, Oils, Lubricant Materials
 - .2 Grubbing, Stripping and Materials Excavation on Land
 - .3 Waste Management
 - .4 Water Management
 - .5 Equipment Movement (Truck Traffic, Lining of Truck Boxes, Cleaning of Truck Body and Tires)
 - .6 Dust Control
 - .7 Erosion Control
 - .8 Noise Control
 - .9 Solid Waste Disposal
 - .10 Sewage Disposal
 - .11 Fencing
 - .4 As sub-sections to the Emergency and Contingency Plans there following:
 - .1 Fuel and Hazardous Materials Spills
 - .2 Travel Load Loss
 - .3 Heritage Resources
 - .5 Each sub-section will include:
 - .1 Principal Environmental Concerns
 - .2 Environmental Protection Procedures
 - .6 The Departmental Representative is to review the EPP prior to any work commencing on site.
 - .1 A draft EPP must be submitted to the Departmental Representative 5 working days prior to any activity commencing on the site.
 - .2 The Departmental Representative's review of the Contractor's Plan will not relieve the Contractor of the responsibility for compliance with applicable environmental regulations.
 - .7 Each Contractor's employee is to be provided an orientation on the final Environmental Protection Plan prior to work commencing on the site. The Contractor will keep a record of the employees and their orientation sessions. Copies of the Environmental Protection Plan will be made available to employees.
-

1.3 ENVIRONMENTAL PROTECTION PLAN
(Cont'd)

- .7 (Cont'd)
- .8 Once the Plan has been submitted to the Departmental Representative, the Contractor must take the necessary steps to ensure its full implementation over the course of the project.
- .9 Submission of the Environmental Protection Plan does not relieve the Contractor in its overall responsibilities for Health and Safety of workers or for its environmental responsibilities, including use, storage and disposal of materials in accordance with governing laws and regulations.

1.4 FIRES

- .1 Fires and burning of rubbish on site permitted are not permitted.

1.5 DISPOSAL OF WASTES

- .1 Burying of rubbish and waste materials on site is not permitted.
 - .2 All waste or volatile materials, such as mineral spirits, oil or paint thinner shall be disposed of in such a manner as to prevent entry into nearby watercourses, storm or sanitary sewers.
 - .3 All waste materials or other materials shall be disposed of in such a way as to prevent entry into nearby watercourses.
 - .4 All waste material, except as specified herein, is to be disposed of at an approved waste disposal site in a manner in accordance with applicable Federal and Provincial laws and regulations.
 - .5 All construction wastes and debris are to be confined to the site limits, stored in suitable, secure piles where possible, and graded as determined by the Departmental Representative. Periodic removal of waste from the site is required (daily upon accumulation).
-

1.6 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Control, filtration and/or treatment of natural runoff, induced runoff or any water containing suspended materials is required.
- .3 All stockpiled materials must be covered and or dyked to prevent erosion and silt-laden runoff.
- .4 Site grading activities should be coordinated with timely placement of fill materials, to minimize the length of time of grading activities. Runoff from any exposed soil areas must be controlled by water control methods such as silt fences to prevent runoff from the site and potential siltation of the adjacent watercourse. The Contractor is responsible for ensuring that all environmental controls are maintained under all weather conditions encountered and that suspended solids levels in water leaving the site are maintained at the levels described below.
- .5 Water released to the environment must be carried out in a manner to avoid disturbance of the receiving watercourse and meet all applicable Federal and Provincial regulations and guidelines.
- .6 Monitoring of the suspended solids will be undertaken by the Departmental Representative of surface drainage from the project site. In accordance with the CCME Environmental Quality Guidelines, the maximum increase of the suspended solids in the receiving watercourses shall not be higher than 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. The level of suspended solids must not increase more than 10% at background levels when background is greater than 250 mg/L. Should an unacceptable level be present, work will be stopped as directed by the Departmental Representative. The Contractor will not be allowed any extra compensation or time resulting from this suspension of work.

1.7 WORK ADJACENT
TO WATERWAYS/
WETLANDS

- .1 Do not operate construction equipment in waterways/wetlands.
 - .2 Do not deposit excavated fill, waste material or debris in waterways/wetlands.
-

- 1.7 WORK ADJACENT TO WATERWAYS/
WETLANDS
(Cont'd)
- .3 Do not skid logs or construction materials across waterways/wetlands.
 - .4 The Contractor is to store equipment and establish project staging in previously disturbed areas and on wetlands.
- 1.8 POLLUTION CONTROL
CONTROL
- .1 Maintain temporary erosion and pollution control features installed under this Contract.
 - .2 Air Pollution:
 - .1 Control emissions from equipment and plant to local authorities emission requirements.
 - .2 Cover or wet down dry materials and rubbish to prevent blowing dust or debris.
 - .3 Transport dusty materials in covered haulage vehicles.
 - .4 Public roadways and existing site road shall be kept clean and free of mud.
 - .5 An independent Contractor will be on site for the duration of the construction period monitoring air quality. If levels are found to exceed acceptable limits on site, work may be stopped and further mitigation may be required.
 - .3 Noise Pollution:
 - .1 Establish and maintain site procedures such that noise levels from construction areas are minimized.
 - .2 Control noise level in accordance with local by-laws.
 - .3 Use vehicles and equipment equipped with efficient muffling devices.
 - .4 Provide and use devices that will minimize noise level in construction area.
 - .4 Refueling Areas:
 - .1 Review in detail proposed route of construction to plan areas, access routes and fueling areas.
 - .2 Establish suitable fueling and maintenance areas and obtain approval from the Departmental Representative.
 - .3 Do not refuel or maintain equipment adjacent to or in watercourse.
 - .4 Do not fuel equipment within 30 meters of any watercourse.
 - .5 Cleaning Equipment:
 - .1 Do not clean equipment in water watercourses.
 - .2 Clean construction equipment prior to driving on public roadways.
-

1.8 POLLUTION
CONTROL
(Cont'd)

- .5 Cleaning Equipment:(Cont'd)
 - .3 Do not clean equipment in locations where debris can gain access to watercourses.
- .6 Spills:
 - .1 Keep all materials required for clean-up of spillage readily accessible on site.
 - .2 Be prepared at all times to intercept, clean-up and dispose of any spillage that may occur whether on land or water.
- .7 Borrow Materials:
 - .1 The Contractor is to make their source for borrow material available to testing by the Departmental Representative at least 7 days prior to the start of work. The borrow material must meet Canadian Council of Minister of the Environment Soil Quality Guidelines.

1.9 WATER MANAGEMENT.
PLAN

- .1 Prepare in writing a Water Management Plan. The Plan must detail the handling methods for all waters that may be present on the project site. The Plan must address water handling during all stages of construction as well as periods of construction suspension.
- .2 The Water Management Plan must incorporate any activities to be under taken by subcontractors if any are employed in the process.
- .3 A draft Water Management Plan must be submitted to the Departmental Representative 5 working days prior to any activity commencing on the site.
- .4 Once the Plan has been submitted to the Departmental Representative, the Contractor must take the necessary steps to ensure its full implementation over the course of the project.
- .5 Submission of the Water Management Plan does not relieve the Contractor in his/her overall responsibilities for Health and Safety of workers or for his/her environmental responsibilities, including release of waters in accordance with governing laws and regulations.

1.10 REGULATIONS

- .1 The work will be carried out in accordance with all applicable Provincial and Federal Regulations.
-

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 31 23 33 - Excavation, Trenching and Backfilling.

1.2 INSPECTION

- .1 Allow Departmental Representative access to Work.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.3 INDEPENDENT
INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
 - .2 Provide equipment required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relieve the Contractor of 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 Departmental Representative at no cost to
-

- 1.3 INDEPENDENT INSPECTION AGENCIES (Cont'd) .4 (Cont'd)
Departmental Representative. Pay costs for retesting and reinspection.
- 1.4 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.
- 1.5 PROCEDURES .1 Notify Departmental Representative 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.
- 1.6 REJECTED WORK .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

PART 1 - GENERAL

1.1 INSTALLATION
AND REMOVAL

- .1 Prepare site plan indicating proposed location of trailers to be used, avenues of ingress/egress.
- .2 Identify areas that have to be graveled to prevent tracking of mud. Temporary wash station for vehicles leaving the site may be required if contractor cannot maintain clean approach to site due to haul traffic.
- .3 Indicate use of supplement or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.2 CONSTRUCTION
PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.

1.3 SECURITY

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays as necessary to protect material, equipment, or the general public in the event of unsafe site conditions.

1.4 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.
-

1.5 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.

1.6 CONSTRUCTION
SIGNAGE

- .1 Direct requests for approval to erect Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.
- .2 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN3-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.7 PROTECTION AND
MAINTENANCE OF
TRAFFIC

- .1 Provide assess to 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 Departmental Representative.
 - .3 Protect traveling public from damage to person and property as a result of work under this contract.
 - .4 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
 - .5 Verify adequacy of existing roads and allowable load limit on these roads. Contractor responsible for repair of damage to roads caused by construction operations.
 - .6 Construct access and haul roads necessary.
 - .7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
 - .8 Dust Control: adequate to ensure safe operation at all times.
-

1.7 PROTECTION AND
MAINTENANCE OF
TRAFFIC
(Cont'd)

- .9 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .10 Provide snow removal during period of Work.
- .11 Remove, upon completion of work, haul roads designated by Departmental Representative.
- .12 If authorized to use existing roads or structures for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contactor's use of roads.
- .13 The Contractor is to maintain full access of the work site. Should a court injunction be required ordering a person or group to refrain from impending access to the site, such as a demonstration, picketing or union action, then obtaining the injunction and any associated costs will be considered incidental to this Contract. Any delays associated with such activity will be considered incidental to this Contract.

1.8 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.

1.9 STORAGE SHEDS

- .1 Provide adequate weather tight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.
- .2 Contractor to make his own arrangements for on-site storage areas.

PART 1 - GENERAL

- 1.1 QUALITY
- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. Furnish evidence as to type, source and quality of products provided.
 - .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
 - .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
 - .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- 1.2 AVAILABILITY
- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
 - .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.
-

1.3 STORAGE,
HANDLING AND
PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.5 MANUFACTURER'S
INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
-

- 1.5 MANUFACTURER'S INSTRUCTIONS (Cont'd)
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
 - .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.
- 1.6 WORK
- .1 Ensure Work is of highest standard, executed by workers approved by Departmental Representative. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
 - .2 Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- 1.7 CO-ORDINATION
- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
 - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
- 1.8 CONCEALMENT
- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except in process areas.
 - .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.
- 1.9 LOCATION OF FIXTURES
- .1 Consider location of mechanical and electrical items indicated as approximate.
 - .2 Inform Departmental Representative of conflicting installation. Install as directed.
- 1.10 FASTENINGS
- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
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- 1.10 FASTENINGS
(Cont'd)
- .2 Prevent electrolytic action between dissimilar metals and materials.
 - .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
 - .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
 - .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
 - .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- 1.11 FASTENINGS -
EQUIPMENT
- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
 - .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 316L stainless steel.
 - .3 Bolts may not project more than one diameter beyond nuts.
 - .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with 316L stainless steel.
- 1.12 PROTECTION OF
WORK IN PROGRESS
- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.
- 1.13 EXISTING
UTILITIES
- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
 - .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in
-

1.13 EXISTING .2 (Cont'd)
UTILITIES manner approved by authority having jurisdiction.
(Cont'd) Stake and record location of capped service.
PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

1.1 GENERAL

- .1 Conduct cleaning and disposal operations to comply with local ordinances and antipollution laws.
- .2 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .3 Prevent accumulation of waste which creates hazardous conditions.

1.2 CLEANING DURING CONSTRUCTION

- .1 Maintain the work area, at least on a daily basis free from accumulations of waste material and debris.
- .2 Provide on-site containers for collection of waste materials, and debris.
- .3 Remove waste materials and debris from site.
- .4 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Provide on-site containers for collection of waste materials and debris as required for contractor's workforce.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

1.3 FINAL CLEANING

- .1 In preparation for acceptance of the project on an interim or final certificate of completion perform final cleaning.
 - .2 Remove grease, dust, dirt, stains, and other foreign materials, from exterior finished surfaces.
 - .3 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
-

- .4 Remove waste products and debris other than that caused by others, and leave Work clean.
- .5 Remove waste products and debris other than that caused by others.
- .6 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative.

PART 1 - GENERAL

1.1 WASTE
MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Waste Management Plan and Goals.
- .2 Waste Management Goal to emphasize maximizing Project Waste diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
 - .2 Inert Fill: inert waste - exclusively asphalt and concrete.
 - .3 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
 - .4 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
 - .5 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
 - .6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
 - .7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse
-

-
- 1.2 DEFINITIONS
(Cont'd)
- .7 Reuse: (Cont'd)
.1 (Cont'd)
on current project or for storage for use on future projects.
.2 Returning reusable items including pallets or unused products to vendors.
- .8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .9 Separate Condition: refers to waste sorted into individual types.
- .10 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
.1 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment, waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
.1 Failure to submit could result in hold back of final payment.
.2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
.3 For each material reused, sold or recycled from project, include amount in tonnes quantities by number, type and size of items and the destination.
.4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.
- 1.4 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)
- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
-

1.4 MATERIALS
SOURCE SEPARATION
PROGRAM (MSSP)
(Cont'd)

- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship materials to site operating under Certificate of Approval.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.5 WASTE
PROCESSING SITES

- .1 Province of: Nova Scotia. For nearest Waste Processing Site, contact Department of Environment.

1.6 STORAGE,
HANDLING AND
PROTECTION

- .1 Store materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

- 1.6 STORAGE,
HANDLING AND
PROTECTION
(Cont'd)
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
 - .8 Separate and store materials produced during dismantling of structures in designated areas.
 - .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.
- 1.7 DISPOSAL OF
WASTES
- .1 Do not bury rubbish or waste materials.
 - .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
 - .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
 - .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
 - .5 Prepare project report to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- 1.8 USE OF SITE
AND FACILITIES
- .1 Execute work with least possible interference or disturbance to normal use of premises.
 - .2 Maintain security measures established by existing facility.
- 1.9 SCHEDULING
- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.
-

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 APPLICATION .1 Do Work in compliance with specifications.
.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
.2 Clean-up work area as work progresses.
.3 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS .1 Separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
.1 Mark containers or stockpile areas.
.2 Provide instruction on disposal practices.
.2 On-site sale of salvaged, recovered, reusable recyclable materials is not permitted.

PART 1 - GENERAL

REQUIREMENTS .1 Section 01 78 00 - Closeout Submittals.

1.1 ADMINISTRATIVE .1 Acceptance of Work Procedures:
REQUIREMENTS .1 Contractor's Inspection: Contractor conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
.2 Request Departmental Representative's inspection.
.2 Departmental Representative's Inspection:
.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
.2 Contractor to correct Work as directed.
.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
.1 Work: completed and inspected for compliance with Contract Documents.
.2 Defects: corrected and deficiencies completed.
.3 Equipment and systems: tested, adjusted and balanced and fully operational.
.4 Certificates required and submitted.
.5 Operation of systems: demonstrated to personnel.
.6 Commissioning of mechanical systems: completed in accordance with specifications and and copies of final Commissioning Report submitted to Departmental Representative.
.7 Underground / Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
.8 Work: complete and ready for final inspection.
.4 Final Inspection:
.1 When completion tasks are done, request final inspection of Work by Departmental Representative.
.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

- 1.2 FINAL CLEANING .1 Clean in accordance with Section 01 74 00 -
Cleaning.
.1 Remove surplus materials, excess materials,
rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse
and recycling in accordance with Section 01 74 21 -
Construction/Demolition Waste Management and
Disposal.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

1.1 ADMINISTRATIVE
REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available and is responsive to inquiries for warranty work action.

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative four final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 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.
 - .1 Identify contents of each binder on spine.
-

1.3 FORMAT
(Cont'd)

- .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, process flow, 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.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS -
PROJECT RECORD
DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 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.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
-

1.5 AS -BUILT
DOCUMENTS AND
SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative 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.
 - .1 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.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING
INFORMATION ON
PROJECT RECORD
DOCUMENTS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
 - .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
 - .3 Record information concurrently with construction progress.
 - .1 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.
-

1.7 EQUIPMENT AND
SYSTEMS

(Cont'd)

- .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 Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test reports.
- .15 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND
FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
 - .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.
-

1.9 MAINTENANCE
MATERIALS

- .1 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.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock 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 location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 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.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.10 DELIVERY,
STORAGE AND
HANDLING

- .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.
-

- 1.10 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)
- .4 Store paints and freezable materials in a heated and ventilated room.
 - .5 Remove and replace damaged products at own expense and for review by Departmental Representative.
- 1.11 WARRANTIES
- .1 Develop warranty management plan to contain information relevant to Warranties.
 - .2 Submit warranty management plan, 30 days before planned pre-warranty conference to Departmental Representative approval.
 - .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
 - .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
 - .5 Submit warranty information made available during construction phase to Departmental Representative for approval prior to each monthly pay estimate.
 - .6 Assemble approved information in binder, submit upon acceptance of work and 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 and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers within ten 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 and bonds until time specified for submittal.
 - .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
 - .8 Conduct joint 4 month and 9 month warranty inspection measured from time of acceptance by Departmental Representative.
-

1.11 WARRANTIES
(Cont'd)

- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include meters and valves.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Report of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
 - .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
 - .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.
-

- 1.12 WARRANTY TAGS .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tags approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
- .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 01 78 00 - Closeout Submittals.
 - .2 Section 01 33 00 - Submittal Procedures.
- 1.2 ADMINISTRATIVE REQUIREMENTS
- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.
 - .2 Departmental Representative: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
 - .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with specifications.
 - .4 Ensure testing, adjusting, and balancing has been performed in accordance with specifications.
 - .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the equipment designated location.
 - .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 needed during instructions.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide 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 weeks prior to designated dates for Departmental Representatives.
-

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.4 QUALITY
ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Departmental Representative's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section: 31 23 33 - Excavating, Trenching and Backfilling.
- 1.2 REFERENCES .1 Reference Standards:
.1 ASTM International
.1 ASTM C 260-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
.2 ASTM C 494/C 494M-13, Standard Specification for Chemical Admixtures for Concrete.
.3 ASTM D 1751-04 (2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
.2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
.3 CSA International
.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.2 CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories.
.3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Specifications.
.2 At least 4 weeks prior to beginning Work, inform Departmental Representative of proposed source of aggregates.
- 1.4 QUALITY ASSURANCE .1 Provide Departmental Representative, minimum 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
-

- 1.4 QUALITY ASSURANCE (Cont'd)
- .1 (Cont'd)
 - .1 (Cont'd) laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
 - .2 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
 - .3 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- 1.5 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.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by.
 - .2 Departmental Representative Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

PART 2 - PRODUCTS

- 2.1 DESIGN CRITERIA
- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.
- 2.2 PERFORMANCE CRITERIA
- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
-

2.3 MATERIALS

- .1 Cement: to CSA A3001, Type GU and HS.
 - .2 Water: to CSA A23.1.
 - .3 Aggregates: to CSA A23.1/A23.2.
 - .4 Admixtures:
 - .1 Air entraining admixture: to ASTM C 260.
 - .2 Chemical admixture: to ASTM C 494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .5 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
 - .1 Compressive strength: 50MPa at 28 days.
 - .2 Net shrinkage at 28 days: maximum 5%.
 - .6 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 50MPa at 28 days.
 - .7 Curing compound: to CSA A23.1/A23.2 and ASTM C 309, Typel-D with fugitive dye.
 - .8 Mechanical waterstops: ribbed extruded PVC Arctic Grade of sizes indicated with shop welded corner and intersecting pieces with legs not less than 100 mm long:
 - .1 Tensile strength: to ASTM D 412, method A, Die "C", minimum 13 MPa.
 - .2 Elongation: to ASTM D 412, method A, Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D 624, method A, Die "B", minimum 30 kN/m.
 - .9 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D 1751.
 - .2 Sponge rubber: to ASTM D 1752, Type I, firm grade.
 - .10 Dampproofing:
 - .1 Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2.
 - .11 Polyethylene film: 6 mil thickness to CAN/CGSB-51.34.
-

- 2.4 MIXES .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
- .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 - .2 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give following properties for concrete in pavement sidewalks, curbs and gutters, and buried structures.
 - .1 Type GU Portland cement.
 - .2 Minimum compressive strength at 28 days: 35 MPa.
 - .3 Class of exposure: C2
 - .4 Chemical admixtures: Type as approved by Departmental Representative and in accordance with ASTM C494.
 - .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

PART 3 - EXECUTION

- 3.1 PREPARATION .1 Obtain Departmental Representative's written approval before placing concrete.
- .1 Provide 24 hours minimum notice prior to placing of concrete.
 - .2 Place concrete reinforcing in accordance with Specifications.
 - .3 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.
 - .4 Pumping of concrete is permitted only after approval of equipment and mix.
 - .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
-

- 3.1 PREPARATION
(Cont'd)
- .7 Protect previous Work from staining.
 - .8 Clean and remove stains prior to application for concrete finishes.
 - .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
 - .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
 - .11 Do not place load upon new concrete until authorized by Departmental Representative.
 - .12 Ensure that founding material on which footings and other concrete work are to be placed are free from water. Place concrete only on frost-free ground. Remove previously frozen bearing surfaces.
 - .13 Ensure that fill has been placed to meet specified requirements and that underslab services have been installed, inspected, tested and approved.
 - .14 Clear reinforcing of rust; mill scale or other loadings they prevent or reduce bond.
 - .15 Maintain concrete protective cover as follows or as noted otherwise.
 - .1 Foundations:
 - .1 Cast against concrete mud slabs: 40 mm.
 - .2 Formed and exposed to earth or weather: 50 mm.
 - .3 Cast against soil: 75 mm.
 - .2 Walls and Columns:
 - .1 Formed and exposed to earth or weather: 50 mm.
 - .2 Protected: 40 mm.
- 3.2
INSTALLATION/
APPLICATION
- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
 - .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
-

3.2
INSTALLATION/
APPLICATION
(Cont'd)

- .2 Sleeves and inserts:(Cont'd)
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.

 - .3 Anchor bolts:
 - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .1 Formed holes: 100 mm minimum diameter.
 - .2 Drilled holes: 25 mm minimum diameter larger than bolts used or to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout or epoxy grout unless specifically needed otherwise.
 - .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 Specifications. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.

 - .5 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

 - .6 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
-

3.2
INSTALLATION/
APPLICATION
(Cont'd)

- .6 Finishing and curing: (Cont'd)
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
 - .4 Use rough form finish for all concrete surfaces not exposed to public view Patch tie holes and defects. Remove fins exceeding 6mm in height.
 - .5 Use smooth form finish for all surfaces exposed to public view. Use form facing material that will produce a smooth, hard, uniform texture on the concrete. Do not use material with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of the concrete surface. Patch the holes and defects, Completely remove fins.
 - .6 Use rubbed finish for all concrete exposed to view with applied finishes that requires a uniform texture and appearance. Use a smooth-rubbed sand-floated or sack-rubbed finish as appropriate.
 - .7 Provide steel trowel surfaces to concrete floor to CSA A23.1, Class A.
 - .1 Floor finisher shall inspect grades, lines, inserts and floor drains prior to commencement of work. Through careful leveling and execution of the work, the floor finisher shall ensure that floors slopes to the appropriate drains. In the event that drains do not collect water efficiently, floor finisher shall repair floor defects at no additional cost and to the satisfaction of the Departmental Representative.
 - .2 Correct floor flatness and waviness deficiencies by grinding.
 - .8 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
 - .7 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 Departmental Representative.
-

3.2
INSTALLATION/
APPLICATION
(Cont'd)

- .8 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 - .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.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

- .9 Perimeter Insulation:
 - .1 Install insulation after building substrate materials are dry.
 - .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
 - .3 Fit insulation closely around pilasters.
 - .4 Cut and trim insulation to fit neatly and with tight joints. Use only insulation boards free from chipped or broken edges.

- .10 In cold weather protect concrete work to CSA-A23.1 and following:
 - .1 Cold weather is defined as a period when the mean air temperature drops below 5⁰C for more than three successive days.
 - .2 When air temperature is above 0⁰C and if forecast to remain so for 48 hours after placing, insulating tarps are acceptable protection provided concrete temperatures are monitored and comply with temperature limits specified in the following paragraphs.
 - .3 For all other cold weather conditions protect concrete with a windproof enclosure of canvas or other material to allow free circulation of inside air around fresh concrete. At no point let walls of enclosure touch formwork and provide sufficient space for removal of formwork and for finishing. Supply approved heating equipment capable of keeping inside air at sufficient curing temperature:
 - .1 For an initial three days, at a temperature of not less than 15⁰C.
 - .2 Maintain concrete at temperatures of not less than 10⁰C for a total period of seven days plus the initial three days specified above.
 - .3 At no time shall concrete temperatures exceed 30⁰C at surfaces.
 - .4 Reduce enclosure air temperature at a rate not exceeding 10⁰C per day until outside air temperature has been reached.

- 3.2 INSTALLATION/
APPLICATION
(Cont'd)
- .10 (Cont'd)
 - .3 (Cont'd)
 - .5 Take temperature readings both of air and of concrete surfaces at several points within area protected at start and at end of working day. Maintain complete records of temperature readings.
 - .4 Ensure that concrete cures, without suffering damage. When enclosure is provided, avoid rapid drying of the concrete.
 - .11 In hot weather protect concrete work to CSA-A23.1 and following:
 - .1 When air temperature is at or above 25 degrees Celsius, do not use curing compounds and keep concrete surfaces moist continually during protection stage using burlap maintained in a moist condition.
 - .2 Generation of heat through solidification of concrete to be regulated to prevent flash setting of concrete.
 - .12 Vapour Barrier:
 - .1 Install polyethylene vapour barrier under concrete slabs-on-grade inside building.
 - .2 Lap vapour barrier minimum 6" at joints and seal.
 - .3 Seal punctures before placing concrete. Using patching material at least 6" larger than puncture and seal.
 - .13 Saw Cutting:
 - .1 Saw cut as soon as concrete has set sufficiently to resist ravelling and displacement of coarse aggregate, and before shrinkage cracks appear.
 - .2 Location and depth of saw cuts are indicated on the Drawings.
- 3.3 SURFACE
TOLERANCE
- .1 Concrete tolerance to CSA A23.1 Straightedge Method, flat: finish tolerance 5mm in 3000mm.
- 3.4 FIELD QUALITY
CONTROL
- .1 Site tests: conduct tests as follows and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days. Also at 56 days when required by concrete exposure classification.
 - .5 Air and concrete temperature.
-

3.4 FIELD QUALITY CONTROL

(Cont'd)

- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory approved by Departmental Representative for review to CSA A23.1/A23.2.
- .1 Ensure testing laboratory is certified to CSA A283.
- .2 Testing: final testing only will be provided by the Departmental Representative's special inspector as deemed necessary, It will be this Section's responsibility to conduct ongoing verification testing and to coordinate final testing with the Departmental Representative's special inspector. Cylinders are to be stored at the project, under the same conditions of temperature and moisture as the floor, until tested.
- .1 This section shall test and provide one set of 3 cylinders for every 100 M³ of concrete placed each days pour. For pours less than 100 M³, provide one set of 3 cylinders for each days pour.
- .3 Contractor will pay for costs of tests as specified.
- .4 Additional test cylinders will be taken during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .6 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

PART 1 - GENERAL

- 1.1 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submittals: in accordance with Specifications.
 - .2 Shop drawings; submit drawings.
 - .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .4 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.
 - .5 In addition to transmittal letter referred to in Specifications: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
 - .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative 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.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
-

- 1.1 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)
- .6 Closeout Submittals:(Cont'd)
- .5 Performance data to include:(Cont'd)
- .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.
- .6 Approvals:
- .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
- .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
- .1 Departmental Representative will provide 1 set of mechanical drawings. Mark changes as work progresses and as changes occur.
- .2 Use different colour waterproof ink for each service.
- .3 Make available for reference purposes and inspection.
- .9 As-built drawings:
- .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .5 Submit completed as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.
-

- 1.2 QUALITY ASSURANCE .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety.
- 1.3 MAINTENANCE .1 Provide one set of special tools required to service equipment as recommended by manufacturers.
- 1.4 DELIVERY, STORAGE, AND HANDLING .1 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Specifications.
- PART 2 - PRODUCTS Not Used.
- PART 3 - EXECUTION
- 3.1 PAINTING REPAIRS AND RESTORATION .1 Prime and touch up marred finished paintwork to match original.
.2 Restore to new condition, finishes which have been damaged.
- 3.2 CLEANING .1 Clean interior and exterior of all systems including strainers.
- 3.3 FIELD QUALITY CONTROL .1 Site Tests: conduct following tests:
.1 Fluid cooler piping water test. System or section shall be able to withstand without leaking a test pressure of 1035 KPa for at least 2 hours without a drop in pressure.
.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 specified
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product
-

- 3.3 FIELD QUALITY CONTROL (Cont'd) .2 Manufacturer's Field Services:(Cont'd)
.2 (Cont'd)
installation in accordance with manufacturer's instructions.
- 3.4 DEMONSTRATION .1 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.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.
- .4 Departmental Representative may record these demonstrations on video tape for future reference.
- 3.5 PROTECTION .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic
Zinc-Rich Coating.
- .2 National Fire Code of Canada (NFCC 2005)
- 1.2 DELIVERY,
STORAGE AND
HANDLING .1 Deliver, store and handle materials in accordance
with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
.1 Deliver materials to site in original factory
packaging, labelled with manufacturer's name,
address.
- .3 Packaging Waste Management: remove for reuse or
recycling of pallets, crates, padding and packaging
materials in accordance with Specifications.

PART 2 - PRODUCTS

- 2.1 MATERIAL .1 Paint: zinc-rich to CAN/CGSB-1.181.
.1 Primers Paints Coating: in accordance with
manufacturer's recommendations for surface
conditions.

PART 3 - EXECUTION

- 3.1 APPLICATION .1 Manufacturer's Instructions: comply with
manufacturer's written recommendations, including
product technical bulletins, handling, storage and
installation instructions, and datasheets.
- 3.2 CONNECTIONS TO
EQUIPMENT .1 In accordance with manufacturer's instructions
unless otherwise indicated.
- .2 Use valves and either unions or flanges for
isolation and ease of maintenance and assembly.
-

- 3.2 CONNECTIONS TO EQUIPMENT
(Cont'd)
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
- 3.3 CLEARANCES
- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.
- 3.4 AIR VENTS
- .1 Install manual air vents to CSA B139 at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.
- 3.5 DIELECTRIC COUPLINGS
- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.
- 3.6 PIPEWORK INSTALLATION
- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
-

3.6 PIPEWORK
INSTALLATION
(Cont'd)

- .6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .8 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .9 Group piping wherever possible.
- .10 Ream pipes, remove scale and other foreign material before assembly.
- .11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .12 Provide for thermal expansion as indicated.
- .13 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Use gate ball or butterfly valves at branch take-offs for isolating purposes except where specified.
 - .6 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .7 Install plug cocks or ball valves for glycol service.
- .14 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

3.7 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and exterior walls.
 - .2 Material: schedule 40 black steel pipe.
 - .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
-

- 3.7 SLEEVES
(Cont'd)
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
 - .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
 - .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.
 - .5 Ensure all exterior wall penetrations are water and weather tight.
- 3.8 ESCUTCHEONS
- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
 - .2 Construction: one piece type with set screws.
 - .1 Chrome or nickel plated brass or type 302 stainless steel.
 - .3 Sizes: outside diameter to cover opening or sleeve.
 - .1 Inside diameter to fit around pipe or outside of insulation if so provided.
- 3.9 PREPARATION
FOR FIRE STOPPING
- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Specifications.
 - .2 Uninsulated unheated pipes not subject to movement: no special preparation.
 - .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
 - .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.
-

- 3.10 FLUSHING OUT OF PIPING SYSTEMS
- .1 Before start-up, flush for one hour.
 - .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
- 3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK
- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
 - .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
 - .3 Maintain specified test pressure without loss for 2 hours minimum unless specified for longer period of time in relevant mechanical sections.
 - .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
 - .5 Conduct tests in presence of Departmental Representative.
 - .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
 - .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.
- 3.12 CLEANING
- .1 Clean in accordance with Specifications.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Specifications.

PART 1 - GENERAL

- 1.1 REFERENCES .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers.
.1 ASHRAE 90.1-2013, Energy Code for Buildings Except Low-Rise Residential Buildings.
- 1.2 ELECTRICAL .1 Electrical work to conform to Division 26 including the following:
.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on Mechanical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.
- 1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with Specifications.
- 1.4 CLOSEOUT SUBMITTALS .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Specifications.

PART 2 - PRODUCTS

- 2.1 GENERAL .1 Motors to be high efficiency, in accordance with the requirements of ASHRAE 90.1.
- 2.2 MOTORS .1 Provide motors for mechanical equipment as specified.
.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.
-

2.2 MOTORS
(Cont'd)

- .3 Motors under 373 W (1/2HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .4 Motors 373 W (1/2HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 C, 3 phase, 600V, unless otherwise specified or indicated.
- .5 Motors to be controlled by variable frequency drives shall be approved and rated for that purpose.

2.3 TEMPORARY
MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
 - .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
 - .3 For motors under 7.5 kW (10HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified rpm.
 - .4 For motors 7.5 kW (10HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
 - .5 Sheave to be sized during commissioning.
 - .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
 - .7 Motor slide rail adjustment plates to allow for centre line adjustment.
 - .8 Supply one set of spare belts for each set.
-

- 2.5 DRIVE GUARDS
- .1 Provide guards for unprotected drives.
 - .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.214mm (18 gauge) thick sheet metal tops and bottoms.
 - .3 38 mm (1 1/2") dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
 - .3 Provide means to permit lubrication and use of test instruments with guards in place.
 - .4 Install belt guards to allow movement of motors for adjusting belt tension.
 - .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.519 (16 gauge) thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
 - .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm (3/4") mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Fasten securely in place.
 - .2 Make removable for servicing, easily returned into, and positively in position.
 - .3 Testing and Commissioning.

PART 1 - GENERAL

- 1.1 REFERENCES .1 ASTM International Inc.
.1 ASTM A 53/A 53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
.2 ASTM A 105/A 105M-05, Standard Specification for Carbon Steel Forgings, for Piping Applications.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Provide submittals in accordance with Specifications.
.2 Product Data:
.1 Provide manufacturer's printed product literature and data sheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
.1 Manufacturer, model number, line contents, pressure and temperature rating.
.2 Movement handled, axial, lateral, angular and the amounts of each.
.3 Nominal size and dimensions including details of construction and assembly.
- 1.3 CLOSEOUT SUBMITTALS .1 Provide maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.
.1 Data to include:
.1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle in accordance with Manufacturer's printed instructions.
.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
.3 Packaging Waste Management: remove for reuse or recycling of pallets, crates, padding and packaging materials in accordance with Specifications.
-

PART 2 - PRODUCTS

- 2.1 FLEXIBLE CONNECTION
- .1 Application: to suit motion or as indicated.
 - .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
 - .3 Inner hose: stainless steel corrugated.
 - .4 Braided wire mesh stainless steel outer jacket.
 - .5 Diameter and type of end connection: as indicated.
 - .6 Operating conditions:
 - .1 To match system requirements.

- 2.2 ANCHORS AND GUIDES
- .1 Alignment guides:
 - .1 By conduit manufacturer.
 - .2 To accomodate specified thickness of insulation.
 - .3 Vapour barriers, jackets to remain uninterrupted.

PART 3 - EXECUTION

- 3.1 APPLICATION
- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and data sheets.

- 3.2 INSTALLATION
- .1 Install expansion joints with cold setting. Make record of cold settings.
 - .2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
 - .3 Install pipe anchors and guides as required.
 - .4 Do welding in accordance with Specifications.
 - .5 Install 600mm (24") long Flex connections on new fluid cooler (typical for four connections).
-

- 3.3 CLEANING .1 Clean in accordance with Specifications.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Specifications.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.
 - .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submittals in accordance with Specifications.
 - .2 Submit shop drawings and product data.
 - .3 Submit manufacturer's product data for following items:
 - .1 Thermometers.
 - .2 Pressure gauges.
 - .3 Stop cocks.
 - .4 Wells.
- 1.3 HEALTH AND SAFETY
- .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety.
- 1.4 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate waste materials for reuse and recycling in accordance with Specifications.
 - .2 Collect, separate and place in designated containers for reuse and recycling paper, plastic, corrugated cardboard, packaging Steel, Metal, Plastic in accordance with Waste Management Plan.
 - .3 Fold up metal banding, flatten and place in designated area for recycling.
 - .4 Place materials defined as hazardous or toxic waste in designated containers.
 - .5 Ensure emptied containers are sealed, labelled and stored safely for disposal away from children.
-

PART 2 - PRODUCTS

- 2.1 GENERAL .1 Design point to be at mid point of scale or range.
- .2 Ranges:
.1 Thermeters.
.2 Heating/Cooling: 15°C to 50°C (0°F to 120°F).
.3 Pressure Gauges: 0-345Kpa (0-50psi).
- 2.2 DIRECT READING THERMOMETERS .1 Industrial, variable angle type, dual scale, liquid filled 230mm scale length: to CAN/CGSB 14.4.
.1 Winters TIM Series.
- 2.3 THERMOMETER WELLS .1 Copper pipe: copper or bronze.
.2 Steel pipe: brass or stainless steel.
- 2.4 PRESSURE GAUGES .1 112 mm, dial type: to ASME B40.100, + 0.5%, Grade 2A, stainless steel, phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified. Dual Scale psi/Kpa.
.1 Winter PPC Series.
- .2 Provide:
.1 Snubber for pulsating operation.
.2 Gasketed pressure relief back with solid front.
.3 Bronze stop cock.
.4 Oil filled.

PART 3 - EXECUTION

- 3.1 GENERAL .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.
-

- 3.2 THERMOMETERS
- .1 Install in wells on piping. Provide heat conductive material inside well.
 - .2 Install in locations as indicated and on inlets and outlets of:
 - .1 Fluid cooler
 - .3 Use extensions where thermometers are installed through insulation.
- 3.3 PRESSURE GAUGES
- .1 Install in following locations:
 - .1 Inlets and outlets of fluid cooler.
 - .2 In other locations as indicated.
 - .2 Use extensions where pressure gauges are installed through insulation.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
 - .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .2 ASTM International
 - .1 ASTM A 276-15, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B 62-15, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B 283/B283M-14a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B 505/B 505M-14, Standard Specification for Copper-Base Alloy Continuous Castings.
 - .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS-SP-25-2013, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS-SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
 - .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Specifications.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Provide maintenance data for incorporation into manual specified in Specifications.
-

1.4 MAINTENANCE
MATERIAL SUBMITTALS

- .1 Extra Materials/Spare Parts:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.
 - .2 Discs: one for every 10 valves, each size. Minimum 1.
 - .3 Stem packing: one for every 10 valves, each size. Minimum 1.
 - .4 Valve handles: 2 of each size.
 - .5 Gaskets for flanges: one for every 10 flanged joints.
 - .2 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse or recycling of pallets, crates, padding, and packaging materials in accordance with Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Valves:
 - .1 Except for specialty valves, to be single manufacturer.
 - .2 Products to have CRN registration numbers.
 - .2 End Connections:
 - .1 Connection into adjacent piping/tubing:
 - .1 Copper tube systems: solder ends grooved ends to ANSI/ASME B16.18.
 - .3 Gate Valves:
 - .1 50mm (NPS 2) and under, rising stem, solid wedge disc, Class 150:
 - .1 Body: with long disc guides, screwed bonnet.
 - .2 Operator: handwheel.
-

2.1 MATERIALS
(Cont'd)

- .4 Globe Valves:
 - .1 Requirements common to globe valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Bonnet: union with hexagonal shoulders.
 - .3 Connections: screwed with hexagonal shoulders.
 - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
 - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
 - .6 Handwheel: non-ferrous.
 - .7 Handwheel Nut: bronze to ASTM B 62.
 - .2 50mm (NPS 2) and under, composition disc, Class 150:
 - .1 Body and bonnet: screwed bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc, regrindable bronze seat, loosely secured to bronze stem to ASTM B 505.
 - .3 Operator: handwheel.
- .5 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .2 50mm (NPS 2) and under, swing type, bronze disc, Class 125:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .3 Stainless steel spring, heavy duty.
 - .4 Seat: regrindable.
- .6 Ball Valves:
 - .1 50mm (NPS 2) and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B 62.
 - .2 Pressure rating: Class125.
 - .3 Connections: screwed ends to ANSI B1.20.1 and with hexagonal shoulders solder ends to ANSI.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable stainless steel solid ball and Teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install rising stem valves in upright position with stem above horizontal.
 - .2 Remove internal parts before soldering.
 - .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

- 3.2 CLEANING
- .1 Clean in accordance with Specifications.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Specifications.

PART 1 - GENERAL

1.1 RELATED SECTIONS.1 Section 23 21 13 - Hydronic Systems - Steel.

1.2 REFERENCES .1 American National Standards Institute
(ANSI)/American Society of Mechanical Engineers
(ASME).
.1 ANSI/ASME B16.1-2003, Cast Iron Pipe Flanges
and Flanged Fittings, Class 25, 125, 250, and 800.
.2 American Society for Testing and Materials (ASTM).
.1 ASTM A 49-12, Specification for Heat-Treated
Carbon Steel Joint Bars.
.2 ASTM A 126-04(2014), Specification for Gray
Iron Castings for Valves, Flanges, and Pipe Fittings.
.3 ASTM B 61-15, Specification for Steam or Valve
Bronze Castings.
.4 ASTM B 62-15, Specification for Composition
Bronze or Ounce Metal Castings.
.5 ASTM B85/B85M-14, Specification for
Aluminum-Alloy Die Castings.
.6 ASTM B 209-14, Specification for Aluminum and
Aluminum-Alloy Sheet and Plate.
.3 Manufacturers Standardization Society of the Valve
and Fittings Industry, Inc. (MSS).
.1 SP-70-2011, Cast Iron Gate Valves, Flanged and
Threaded Ends.
.2 SP-71-2011, Cast Iron Swing Check Valves,
Flanged and Threaded Ends.
.3 SP-82-1992, Valve Pressure Testing Methods.
.4 SP-85-2011, Cast Iron Globe and Angle Valves,
Flanged and Threaded Ends.

1.3 PRODUCT DATA .1 Submit product data in accordance with
Specifications.
.2 Submit data for valves specified in this section.

1.4 CLOSEOUT
SUBMITTALS .1 Submit maintenance data for incorporation into
manual specified in Specifications.

- 1.5 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate and recycle waste materials.
 - .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 - PRODUCTS

- 2.1 GENERAL
- .1 Except for specialty valves, to be of single manufacturer.
 - .2 Standard specifications:
 - .1 Gate valves: MSS SP-70.
 - .2 Globe valves: MSS SP-85.
 - .3 Check valves: MSS SP-71.
 - .3 Requirements common to valves, unless specified otherwise:
 - .1 Body, bonnet: cast iron to ASTM B 209 Class B.
 - .2 Connections: flanged ends with 1/16" raised face with serrated finish to ANSI B16.1.
 - .3 Inspection and pressure testing: to MSS SP-82.
 - .4 Bonnet gasket: non-asbestos.
 - .5 Stem: to have precision-machined Acme or 60°V threads, top screwed for handwheel nut.
 - .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
 - .7 Gland packing: non-asbestos.
 - .8 Handwheel: Die-cast aluminum alloy to ASTM B 85 or malleable iron to ASTM A 49. Nut of bronze to ASTM B 62.
 - .9 Identification tag: with catalogue number, size, other pertinent data.
 - .4 All products to have CRN registration numbers.
- 2.2 GATE VALVES
- .1 65mm-200mm (NPS 2 1/2 - 8), non rising stem, inside screw, bronze trim, solid wedge disc:
 - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 125, WP = 862kPa (125 psi) steam, 1380kPa (200psi) CWP.
 - .2 Disc: solid offset taper wedge, bronze to ASTM B 62 up to and including NPS 3, bronze rings rolled into cast iron disc on other sizes, secured to bronze stem to ASTM B 62.
 - .3 Seat rings: renewable bronze to ASTM B 62, screwed into body.
-

- 2.2 GATE VALVES .1 (Cont'd)
(Cont'd)
.4 Stem: bronze to ASTM B 62.
.5 Operator: handwheel
- 2.3 GLOBE VALVES .1 65mm - 200mm (NPS (2 1/2 - 10), OSY:
.1 Body: with multiple-bolted bonnet.
.2 WP: 862kPa (125psi) steam, 1380kPa (200psi)
CWP.
.3 Bonnet-yoke gasket: non-asbestos.
.4 Disc: bronze to ASTM B 62, fully guided from
bottom, securely yet freely connected to stem for
swivel action and accurate engagement with disc.
.5 Seat ring: renewable, regrindable, screwed into
body.
.6 Stem: bronze to ASTM B 62.
.7 Operator: Handwheel.
- 2.4 VALVE OPERATORS .1 Install valve operators as follows:
.1 Handwheel: on valves except as specified.
.2 Handwheel with chain operators: on valves
installed more than 2440mm (8') above floor in
mechanical room.
- 2.5 CHECK VALVES .1 Swing check valves, Class 125:
.1 Body and bolted cover: with tapped and plugged
opening on each side for hinge pin. Flanged ends:
plain faced with smooth finish.
.1 Up to 406mm (NPS 16): cast iron to ASTM A
126 Class B.
.2 460mm (NPS 18) and over: cast iron to ASTM
A 126 Class C.
.2 Ratings:
.1 65mm-305mm (NPS 2 1/2 - 12): 862kPa
(125psi) steam; 1380kPa (200psi) CWP.
.2 355mm-406mm (NPS 14 - 16): 862kPa (125psi)
steam; 1034kPa (150psi) CWP.
.3 460mm (NPS 18 and over): 1034kPa (150psi)
CWP.
.3 Disc: Rotating for extended life.
.1 Up to 150mm (NPS 6): bronze to ASTM B 62.
.2 200mm (NPS 8) and over: bronze-faced cast
iron.
.4 Seat rings: renewable bronze to ASTM B 62
screwed into body.
.5 Hinge pin, bushings: renewable bronze to ASTM B
62.
.6 Identification tag: fastened to cover.
.7 Hinge: galvanized malleable iron.
-

2.6 SILENT CHECK VALVES

.1 Construction:

- .1 Body: malleable iron with integral seat.
- .2 Pressure rating: Class 125, WP = 862kPa (125psi).
- .3 Connections: grooved ends.
- .4 Disc: bronze or stainless steel renewable rotating disc.
- .5 Seat: renewable, EPDM.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.3-04, Process Piping.
 - .2 ASTM International
 - .1 ASTM A 563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
 - .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Provide submittals in accordance with Specifications.
 - .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Provide maintenance data for incorporation into manual specified in Specifications.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .3 Packaging Waste Management: remove for reuse and/or recycling of pallets, crates, padding, and packaging materials in accordance with Specifications.
-

PART 2 - PRODUCTS

- 2.1 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 SP 58.
 - .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 SP 58.
- 2.2 GENERAL .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58. ANSI B31.1 and as indicated.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- 2.3 PIPE HANGERS .1 Finishes:
- .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use electro-plating galvanizing process hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
- .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 3 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, FM approved.

-
- 2.3 PIPE HANGERS
(Cont'd)
- .3 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate FM approved to MSS SP 69.
 - .4 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies: to MSS SP58.
 - .2 Steel brackets: to MSS SP58.
 - .5 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .6 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: epoxy coated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
 - .7 Adjustable clevis: material to MSS SP 69 FM approved, 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.
 - .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.
 - .9 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A 563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion epoxy coated.
 - .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69.
-
- 2.4 RISER CLAMPS
- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, FM approved.
 - .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
 - .3 Bolts: to ASTM A 307.
-

-
- 2.4 RISER CLAMPS .4 Nuts: to ASTM A 563.
(Cont'd)
- 2.5 INSULATION .1 Insulated cold piping:
PROTECTION SHIELDS .1 64 kg/m³ density insulation plus insulation
protection shield to: MSS SP 69, 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 SP 69.
- 2.6 EQUIPMENT .1 Fabricate equipment supports not provided by
& PIPING SUPPORTS equipment manufacturer from structural grade 316L
steel.
- 2.7 EQUIPMENT .1 Provide templates to ensure accurate location of
ANCHOR BOLTS AND anchor bolts.
TEMPLATES
- 2.8 EQUIPMENT .1 Provide concrete pads for base-mounted equipment;
PADS size pads larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-Place
Concrete.
- 2.9 OTHER .1 Fabricate equipment supports from structural grade
EQUIPMENT SUPPORTS steel meeting 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 datasheet.
- 3.2 INSTALLATION .1 Install in accordance with:
.1 Manufacturer's instructions and recommendations.
.2 Vibration Control Devices:
.1 Install on piping systems at pumps, heat pumps, and as indicated.
.3 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 Clevis plates:
.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
.6 Use approved constant support type hangers where:
.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.
.7 Use variable support spring hangers where:
.1 Transfer of load to adjacent piping or to connected equipment is not critical.
.2 Variation in supporting effect does not exceed 25 % of total load.
- 3.3 HANGER SPACING .1 Plumbing piping: to Canadian Plumbing Code and Provincial Building Code.
.2 Copper piping: up to 12mm (NPS 1/2): every 1.5 m.
-

3.3 HANGER SPACING (Cont'd) .3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.4 Within 300 mm of each elbow.

<u>Maximum Pipe Size :mm(NPS)</u>	<u>Maximum Spacing Steel</u>	<u>Maximum Spacing Copper</u>
up to 32 (1-1/4)	2.4 m	1.8 m
38 (1-1/2)	3.0 m	2.4 m
50 (2)	3.0 m	2.4 m
64 (2-1/2)	3.7 m	3.0 m
75 (3)	3.7 m	3.0 m
90 (3-1/2)	3.7 m	3.3 m
100 (4)	3.7 m	3.6 m
127 (5)	4.3 m	
150 (6)	4.3 m	
200 (8)	4.3 m	
250 (10)	4.9 m	
300 (12)	4.9 m	

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.

3.6 FINAL
ADJUSTMENT
(Cont'd)

- .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.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

- .1 Clean in accordance with Specifications.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Specifications.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
.2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Product Data: Insulation types and Jacket material.
.2 Submittals: in accordance with Specifications.
.3 Product data to include paint colour chips, other products specified in this section.
- 1.3 DELIVERY, STORAGE, AND HANDLING .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Specifications.
.2 Dispose of unused paint coating material at official hazardous material collections site.
.3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

- 2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
.2 Lettering and numbers raised or recessed.
.3 Information to include, as appropriate:
.1 Equipment: manufacturer's name, model, size, serial number, capacity.
.2 Motor: voltage, Hz, phase, power factor, duty, frame size.
-

2.2 SYSTEM
NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

Size #	mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1		10 x 50	1	3
2		13 x 75	1	5
3		13 x 75	2	3
4		20 x 100	1	8
5		20 x 100	2	5
6		20 x 200	1	8
7		25 x 125	1	12
8		25 x 125	2	8
9		35 x 200	1	20
 - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.

2.3 IDENTIFICATION
OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

2.3 IDENTIFICATION
OF PIPING SYSTEMS
(Cont'd)

- .4 Arrows showing direction of flow: (Cont'd)
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from Departmental Representative.
 - .2 Colours for legends, arrows: to following table:

<u>Background colour:</u>	<u>Legend, arrows:</u>
Yellow	BLACK
Green	WHITE
Red	WHITE

- 2.3 IDENTIFICATION OF PIPING SYSTEMS (Cont'd) .7 Colours and Legends:(Cont'd)
.2 Colours for legends, arrows:(Cont'd)

- .3 Background colour marking and legends for piping systems:
Background colour: Legend, arrows:

Contents	Background colour marking	Legend
Geothermal Water Supply	Green	GGs
Geothermal Water Return	Green	GGR
Glycol Fill	Green	GLY FILL

- 2.4 IDENTIFICATION DUCTWORK SYSTEMS .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

- 2.5 VALVES, CONTROLLERS .1 Lamacoid tags with 12 mm engraved identification data.

- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

- 2.6 CONTROLS COMPONENTS IDENTIFICATION .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

- .2 Inscriptions to include function and (where appropriate) fail-safe position.

- 2.7 LANGUAGE .1 Identification in English.
-

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 TIMING .1 Provide identification only after painting has been completed.
- 3.3 INSTALLATION .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
.2 Provide ULC and or CSA registration plates as required by respective agency.
- 3.4 NAMEPLATES .1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.
.2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.
.3 Protection:
.1 Do not paint, insulate or cover.
- 3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
.2 Adjacent to each change in direction.
.3 At least once in each small room through which piping or ductwork passes.
.4 On both sides of visual obstruction or where run is difficult to follow.
.5 On both sides of separations such as walls, floors, partitions.
-

3.5 LOCATION OF
IDENTIFICATION ON
PIPING AND DUCTWORK
SYSTEMS

(Cont'd)

- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES,
CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 CLEANING

- .1 Proceed in accordance with Specifications.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 23 05 05 Installation of Pipework.
 - .2 Section 23 21 14 Hydronic Specialties.

PART 2 - PRODUCTS

- 2.1 CLEANING SOLUTIONS
- .1 Tri-sodium phosphate: 0.45kg (1lb) per 95 litres (25 gal.)water in system.
 - .2 Sodium carbonate: 0.45kg (1lb) per 95 litres (25 gal.)water in system.
 - .3 Low-foaming detergent: 15ml (1/2oz) per 95 litres (25 gal.) water in system.

PART 3 - EXECUTION

- 3.1 CLEANING HYDRONIC SYSTEMS
- .1 Timing:
 - .1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
 - .2 Cleaning agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
 - .3 Install instrumentation only after cleaning is certified as complete by water treatment specialist.
 - .4 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 2 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations to be used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water to be used to ensure water will not damage systems or equipment.
-

3.1 CLEANING
HYDRONIC
SYSTEMS
(Cont'd)

- .5 Conditions at time of cleaning of systems
 - .1 Systems to be free from construction debris, dirt and other foreign material.
 - .2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers to be clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.
 - .5 Install pressure gauges on strainers to detect plugging.

- .6 Report on Completion of Cleaning
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

- .7 Hydronic Systems:
 - .1 Fill system with water, ensure air is vented from system.
 - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
 - .3 Use water meter to record volume of water in system to +/- 0.5%.
 - .4 Add chemicals under direct supervision of chemical treatment supplier.
 - .5 Closed loop systems: circulate system cleaner at 60°C for at least 36 h. Drain as quickly as possible. Refill with water plus inhibitors. Test concentrations and adjust to recommended levels.
 - .6 Flush velocity in system mains and branches to be adequate so as to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
 - .7 Add chemical solution to system.
 - .8 Establish circulation, raise temperature slowly to maximum design or 60°C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38°C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphate (test for residual sulphate).

3.2 START-UP OF
HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure all air is removed.

3.2 START-UP OF
HYDRONIC SYSTEMS
(Cont'd)

- .1 (Cont'd)
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
 - .5 Clean out strainers repeatedly until system is clean.
 - .6 Commission water treatment systems as specified.
 - .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
 - .8 Repeat with water at design temperature.
 - .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and all other noises.
 - .10 Bring system up to design temperature and pressure slowly.
 - .11 Perform TAB as specified.
 - .12 Adjust pipe supports, hangers, springs as necessary.
 - .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
 - .14 Re-tighten all bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
 - .15 Check operation of drain valves.
 - .16 Adjust valve stem packings as systems settle down.
 - .17 Fully open all balancing valves (except those that are factory-set).
 - .18 Check operation of over-temperature protection devices on circulating pumps.
 - .19 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Division 1.
- .2 Section 23 05 05 - Installation of Pipework.
- .3 Section 23 05 23 - Valves - Bronze.
- .4 Section 23 05 24 - Valves - Cast Iron.

1.2 REFERENCES

- .1 American National Standards Institute
(ANSI)/American Society of Mechanical Engineers
(ASME)
 - .1 ANSI/ASME B16.1-10, Cast Iron Pipe Flanges and Flanged Fittings, (Class 25, 125 and 250).
 - .2 ANSI/ASME B16.3-11, Malleable-Iron Threaded Fittings, (Classes 150 and 300).
 - .3 ANSI/ASME B16.5-13, Pipe Flanges and Flanged Fittings.
 - .4 ANSI/ASME B16.9-12, Factory-Made Wrought Buttwelding Fittings.
 - .5 ANSI/ASME B18.2.1-12, Square and Hex Bolts and Screws.
 - .6 ANSI/ASME B18.2.2-10, Square and Hex Nuts.
 - .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 47/A47M-04, Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A 53/A53M-12, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A 536-84(2014), Specification for Ductile Iron Castings.
 - .4 ASTM B 61-15, Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B 62-15, Specification for Composition Bronze or Ounce Metal Castings.
 - .3 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C111/A21.11-12, Rubber Gasket Joints for Ductile-Iron, Pressure Pipe and Fittings.
 - .4 Canadian Standards Association (CSA)
 - .5 CSA B242-2005 (R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .6 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
-

- 1.2 REFERENCES .7 Manufacturer's Standardization of the Valve and
(Cont'd) Fittings Industry (MSS)
.1 MSS-SP-70-11, Cast Iron Gate Valves, Flanged
and Threaded Ends.
.2 MSS-SP-71-11, Cast Iron Swing Check Valves
Flanged and Threaded Ends.
.3 MSS-SP-80-13, Bronze Gate, Globe, Angle and
Check Valves.
.4 MSS-SP-85-11, Cast Iron Globe and Angle Valves,
Flanged and Threaded Ends.

- 1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with
Specifications.

- 1.4 CLOSEOUT .1 Provide maintenance data for incorporation into
SUBMITTALS manual.

- 1.5 WASTE .1 Separate and recycle waste materials.
MANAGEMENT AND
DISPOSAL .2 Collect and separate plastic, paper packaging and
corrugated cardboard in accordance with Waste
Management Plan.
.3 Fold up metal banding, flatten and place in
designated area for recycling.

PART 2 - PRODUCTS

- 2.1 PIPE .1 Steel pipe: to ASTM A53, Grade B, as follows:
.1 Up to 150mm (NPS6), Schedule40.

- 2.2 PIPE JOINTS .1 50mm (NPS2) and under: screwed fittings with teflon
tape or pulverized lead paste.
.2 65mm (NPS2-1/2) and over: welding fittings and
flanges to CSA W47.1 and CSA W47.1S1.
.3 Flanges: plain or raised face, slip-on.
.4 Orifice flanges: slip-on raised face, 300 psi.
.5 Flange gaskets: to ANSI/AWWA C111/A21.11.
-

2.2 PIPE JOINTS
(Cont'd)

- .6 Pipe thread: taper.
- .7 Bolts and nuts: to ANSI/ASME B18.2.1 and ANSI/ASME B8.2.2.
- .8 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ANSI/ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
 - .1 Cast iron: to ANSI/ASME B16.1, Class 125.
 - .2 Steel: to ANSI/ASME B16.5.
- .3 Butt-welding fittings: steel, to ANSI/ASME B16.9.
- .4 Unions: malleable iron, to ASTM A 47/A47M and ANSI/ASME B16.3.
- .5 Fittings for all grooved piping: Ductile Iron to ASTM A536, All grooved products to be of one manufacturer.

2.4 VALVES

- .1 Connections:
 - .1 65mm (NPS2) and smaller: screwed ends.
 - .2 50mm (NPS2.1/2) and larger: Flanged ends.
 - .2 Circuit Balancing valves, for TAB:
 - .1 General
 - .1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports for connected to differential pressure meter.
 - .2 Accuracy:
 - .1 Readout to be within plus or minus 2% actual flow at design flow rate.
 - .3 Pressure die-cast dezincification resistant copper alloy construction, 250 psi, 121C, screwed ends, EPDM 'O' ring seal, screw-in bonnet.
 - .4 Insulation:
 - .1 Use prefabricated shipping packaging of 5.4 polyurethane as insulation.
 - .5 Drain connection:
 - .1 19mm (NPS 3/4) valved and capped, suitable for hose socket.
 - .2 Incorporated into valve body or provided as separate item.
-

PART 3 - EXECUTION

- 3.1 PIPING
INSTALLATION .1 In accordance with Section 23 05 05.
- 3.2 CIRCUIT
BALANCING VALVES .1 Install flow balancing valves on all branches,
pumps, equipment, calcs.
.2 Remove handwheel after installation and when TAB is
complete.
- 3.3 FLUSHING AND
CLEANING .1 In accordance with Section 23 08 02.
- 3.4 TESTING .1 Test system in accordance with Section 23 05 05.
- 3.5 BALANCING .1 Balance water systems to within plus or minus 5% of
design output.

PART 1 - GENERAL

- 1.1 REFERENCES .1 American Society of Mechanical Engineers (ASME)
.1 ANSI/ASME-15, Boiler and Pressure Vessels Code (BPVC).
.2 American Society for Testing and Materials (ASTM)
.1 ASTM A 47/A47M-99-(2014), Specification for Ferritic Malleable Iron Castings.
.2 ASTM A 278M-01-(2011), Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 345°C.
.3 ASTM A 516/A 516M-10, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
.4 ASTM A 536-84(2014), Specification for Ductile Iron Castings.
.5 ASTM B 62-15, Specification for Composition Bronze or Ounce Metal Castings.
.3 Canadian Standards Association (CSA)
.1 CSA B51-14, Boiler, Pressure Vessel, and Pressure Piping Code.
- 1.2 PRODUCT DATA .1 Submit product data in accordance with Specifications.
.2 Indicate on product data, air vents, valves, strainers, circuit balancing valves.
- 1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with Specifications.
- 1.4 CLOSEOUT SUBMITTALS .1 Submit maintenance data in accordance with Specifications.
- 1.5 WASTE MANAGEMENT AND DISPOSAL .1 Separate and recycle waste materials in accordance with Specifications.
.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
-

PART 2 - PRODUCTS

- 2.1 CANADIAN
REGISTRATION
NUMBERS (CRN)
- .1 CRN numbers required on all products as per Provincial Regulations and CSA B51.
- 2.2 AUTOMATIC AIR
VENT
- .1 Standard float vent: brass body and 3mm (NPS 1/8) connection and rated at 1034kPa (100 psi) working pressure.
 - .2 Float: solid material suitable for 115°C working temperature.
- 2.3 PIPE LINE
STRAINER
- .1 12mm to 25mm (NPS 1/2 to 2): bronze body to ASTM B 62, solder end or screwed connections, Y pattern.
 - .2 Blowdown connection: 25mm (NPS 1). Complete with ball valve and plug.
 - .3 Screen: stainless steel or brass with .05mm (3/64") perforations.
 - .4 Working pressure: 1034kPa (100 psi).
- 2.4 GLYCOL
MAKEUP PACKAGE
- .1 See equipment schedule on Drawings for more information.
 - .2 12mm (1/2 FNPT) system valve.
 - .3 Lift with recovery line from system relief valve.
 - .4 Storage/mixing tank with cover; pump suction hose with inlet strainer; pressure pump with thermal cut-out; integral pressure switch; integral check valve; 115vac cord and plug; pre-charged accumulator 208 litre tank with EPDM diaphragm; manual diverter valve for purging air and agitating contents of storage tank; pressure regulating valve adjustable (35-380 KPa; (5-55 psig) complete with pressure gauge; integral replaceable strainer; built-in check valve; union connection; 12mm (1/2") x 900mm (36") long flexible connection hose with check valve; low level pump cut-out. Pressure pump shall be capable of running dry without damage. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard C22.2 No. 68.
-

2.4 GLYCOL
MAKEUP PACKAGE
(Cont'd) .5 Accessories: Low level alarm panel complete with
remote monitoring dry contacts and selectable audible
alarm.

2.5 PREMIXED
GLYCOL SOLUTION .1 35 % Propylene Glycol with dye and corrosion
inhibitor.
.2 Acceptable products: Dowfrost or approved
equivalent.
.3 Supply extra 1041 litres (275 gallon) tote of P.G.
solution.
.4 Supply hygrometer.

PART 3 - EXECUTION

3.1 GENERAL .1 Install as indicated and to manufacturer's
recommendations.
.2 Run drain lines and blow off connections to
terminate above nearest drain.
.3 Maintain proper clearance to permit service and
maintenance.
.4 Should deviations beyond allowable clearances arise,
request and follow Departmental Representative's
directive.
.5 Check shop drawings for conformance of all tappings
for ancillaries and for equipment operating weights.

3.2 STRAINERS .1 Install in horizontal or down flow lines.
.2 Ensure clearance for removal of basket.
.3 Install ahead of each pump.
.4 Install ahead of each automatic control valve larger
than 25mm (NPS 1) except at radiation and as
indicated.

- 3.3 AIR VENTS .1 Install at high points of systems.
.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.
- 3.4 CONTROL VALVES .1 Control valves are supplied by controls contractor, installed by mechanical contractor.
- 3.5 CIRCUIT BALANCING VALVES .1 Install circuit balancing valves complete with flow measuring fittings for all heating coils, unit heaters, force flow heaters, fan coils, heat pumps, pumps, baseboard radiation.
- 3.6 GLYCOL MAKEUP PACKAGE .1 Fill entire geothermal loop side of system with propylene glycol (35%). Leave the glycol tank 50% full. Refer to drawings for glycol systems which include but are not limited to: The geothermal loop side (heat exchanger HE-1, new fluid cooler, heat pump HP-1, HP-2, HP-3, HP-4, etc.).

PART 1 - GENERAL

1.1 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
 - .2 Shop Drawings:
 - .1 Submit shop drawings.
 - .2 Indicate:
 - .1 Connections, piping, fittings, control assemblies, ancillaries, etc. identifying factory and field assembled.
 - .2 Wiring as assembled and schematically.
 - .3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.
 - .4 Manufacturers recommended clearances.
 - .3 Quality assurance submittals: submit the following:
 - .1 Test reports:
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
 - .4 Manufacturer's Field Reports: manufacturer's field reports specified.
 - .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual.
 - .2 Include:
 - .1 Description of equipment giving manufacturers name, type, model year, capacity.
 - .2 Start-up and commissioning procedures.
 - .3 Details of operation, servicing and maintenance.
 - .4 Recommended spare parts list.

- 1.2 QUALITY ASSURANCE .1 Manufacturer's Field Services: Performed by company or person approved by manufacturer and Departmental Representative. Startup/commissioning of unit by manufacturers fields services representative. Manufacturer's Representative to coordinate with general Contractor.
- 1.3 DELIVERY, STORAGE, AND HANDLING .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions.
- .2 Storage and Protection:
.1 Store materials indoors in dry location.
.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.
- 1.4 MAINTENANCE .1 Extra Materials:
.1 Furnish required spare parts:.
.2 Furnish spare parts data for each different item of equipment specified.
.3 Include with data complete list of parts and supplies, recommended spare parts list for 1 year of operation, and list of parts recommended by manufacturer to be replaced on routine basis.

PART 2 - PRODUCTS

- 2.1 COILS .1 Coils to be manufactured using seamless, deoxidized, heavy wall, smooth copper tubes, mechanically expanded in self spaced full collared aluminum corrugated plate fins for permanent bond and maximum heat transfer. Connections and bends to be brazed with high temperature brazing alloy. The coil to be factory leak tested at 2758kPa(400 psig). All tubes sheets to be provided with oversized holes and tubes supported in sliding cushions from friction free assembly and maximum reliability. Coils and fins to be coated with Blygold.
-

- 2.2 HEADERS .1 Headers to be made with seamless copper tube and connections made with pipe-threaded seamless red brass pipe. Headers to include 13mm (1/2") NPT drain and vent. Headers to be coated with Blygold.
- 2.3 CASINGS .1 Casings for all fluid coolers to be heavy gauge galvanized steel G90 with plated hardware for a corrosion free assembly. The cabinet to be sectionalized with individual fan chambers. The unit it to be of bolted construction. Coil section to be independent of the fan section. Unit to be provided with 185mm (7 1/4") full bell mouth venturies. Unit to have side access panels for easy coil inspection and cleaning. Casings and structural support stands to be painted:grey baked epoxy powder coat.
- 2.4 FANS .1 Fans to be die cast aluminum; provided in a sickle shape design for optimal sound behavior and low noise. Fan hubs to be intregated to the external motor rotor, statically and dynamically balanced for smooth and vibration free operation 800mm (31 1/2") diameter with 7 blades. Fan venturi's and protective cages to be painted: black epoxy powder coat.
- 2.5 FAN MOTORS .1 Fan Motors to be totally enclosed, reverse rotor design, permanently lubricated double sealed deep groove ball bearings. Greased with special all temperature grease from sub zero to class F. Motors to be thermally protected, 575 3 phase 60 Hz.
- 2.6 FAN GUARDS AND MOTOR MOUNTS .1 Fan Guards and Motor Mounts to be welded wire construction for full protection from moving parts with baked on powder epoxy coating for corrosion protection.
- 2.7 CONTROL PANELS .1 Control panels and controllers to come complete with motor contactors and fuses (per motor) temperature, sensors, fan cycling, terminal block and control transformer (Primary voltage is 600V and secondary voltage is 24V). Two speed applications timer, thermostat to be used as the last control to switch from low to high speed. Ambient control and sequencing, controller, auxiliary contact on
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-
- 2.7 CONTROL PANELS .1 (Cont'd)
(Cont'd) contactors, non fused weather proof disconnect. Panel to be painted: grey baked powder epoxy coat.
- 2.8 ALL MOTORS .1 All motors are wired to weather resistance box. The unit is provided with terminal blocks for easy field installation. Terminals are clearly identified to match wiring diagram supplied with the unit. Motors are wired using flexible cord type SOW 90°C #16 AWG and they are terminated with liquid tight straight-thru fittings.
- 2.9 SIZE AND WEIGHT .1 Maximum Size: 6033mm L x 940mm W x 2515mm H.
.2 Maximum Weight: 1837.5kg (4,051 lbs).
.3 See attached drawing.
- 2.10 CAPACITY/FLUID COOLER SCHEDULE .1 Horizontal air flow type.
.2 Fluid Cooler Capacity/Schedule:
.1 Fluid: 35% P.G.
.2 Electrical Supply:
.1 575/3/60
.2 FLA: 2.0
.3 MCA: 16.5
.4 MOCP: 20
.3 EWT °C (°F): 41.6 (106.9) / LWT °C (°F): 36.0 (97.0)
.4 Total Cooling KW (MBH): 266.2 (908.4)
.5 Coil WPD kPa (FT): 21.37 (7.15)
.6 #Circuits/Connection mm (IN): 2/75 (3)
.7 Dimensions mm (IN) LxWxH: 6033x940x2515 (237.5x37x99)
.8 # Fans: 8
.9 Fan Arrangement: 2 x 4
.10 Comments: Horizontal air flow 30.6°C (87°F) entering dry bulb), 12.4eps (196.5 USGPM), C/W control panel with enclosed controller (VPC-P57-24-8-X-AEL), or approved equivalent; electronic aquastats, first stage cycling twin speed Ziehl-Abegg, control contactors, controls XFMR (600 to 24 volt), motor fusing, non fused disconnect, auxiliary contact, blygold fin coating (or approved equivalent).
.11 Acceptable Material: Refplus FVD244FH-8-F116, or approved equivalent.
-

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 GENERAL .1 Verify unit mount on structural supports and vibration isolators as indicated and to manufacturer's recommendations.
- .2 Ensure clearance for servicing and maintenance as recommended by manufacturer.
- .3 Manufacturers field service representative to approve installation, to supervise start up, commissioning, and to instruct operators.
- 3.3 FIELD QUALITY CONTROL .1 Site Tests of Fluid Cooler:
- .1 Test under actual operating conditions in accordance with manufacture's recommendations to verify specified performance.
- .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.
- .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.
- 3.4 ADJUSTING .1 Lubricate bearings with oil or grease as recommended by manufacturer.
- .2 Tighten belts to manufacturer's specified tension.
-

- 3.5 CLEANING
- .1 Wipe equipment clean, and remove traces of oil, dust, dirt, or paint spots.
 - .2 Maintain system in clean condition until final acceptance.
 - .3 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- 3.6 WARRANTY
- .1 Warranty period is to start from time of commissioning, substantial completion.

PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Average Effectiveness Level (AEL): Ratio between a thirty day test period less any system down time accumulated within that period, and the thirty day period.

1.2 REFERENCES

- .1 American National Standards Institute
 - .1 ANSI/ASME B16.22-13, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .2 ANSI/IEEE C2-2012, National Electrical Safety Code.
 - .3 ANSI/NFPA 70-2012, National Electrical Code.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installation.
 - .2 CAN/CSA C22.3 No.1-15, Overhead Systems.
 - .3 CSA C22.3 No.7-2015, Underground Systems.
 - .4 CSA C22.2 No. 45.1-07 (R2012), Electrical Rigid Metal Conduit - Steel.
 - .5 CSA C22.2 No. 56-13 (R2009), Flexible Metal Conduit and Liquid Tight Metal Conduit.
 - .6 CSA C22.2 No. 83-M1985 (R2013), Electrical Metal Tubing.

1.3 DESIGN
PERFORMANCE
REQUIREMENTS

- .1 Provide modifications to existing stand alone, direct digital system for control, management, and monitoring of new devices and equipment.
 - .2 Monitor and control all HVAC Systems.
 - .3 System shall be able to communicate utilizing existing native BACnet architecture.
 - .4 Provide additional digital controllers, programmable and independently operable (stand alone) as required.
 - .5 Contractor to supply and install control wiring. Contractor to provide and install sensors and control devices. Contractor to make final connections to equipment and devices.
-

- 1.4 NATIVE BACNET PERFORMANCE REQUIREMENTS
- .1 Partially update existing native BACnet based system as required. All building controllers, application controllers and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2001, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.
 - .2 Provide all necessary BACnet compliant hardware and software to meet the systems functional specifications. Provide protocol implementation conformance statement (PICS) for windows based control software and every controller in system, including unitary controllers.
- 1.5 SUBMITTALS
- .1 Provide product data in accordance with Specifications.
 - .2 Submit shop drawings in accordance with Specifications.
 - .1 Include wiring diagrams, schematics, and sequence of operation for entire system.
 - .2 Describe in detail sequence of logic operations for analog outputs (AO) and digital outputs (DO) control loop.
 - .3 Mechanical control schematics.
 - .1 Motor starter and equipment control schedule and schematic.
 - .2 Control System Electrical Ladder Diagram or Electrical Control Schematics.
 - .4 Updated Input and output point schedule.
 - .3 Submit product data in accordance with Specifications.
 - .1 Provide for purchased components.
 - .2 Include complete technical information regarding operating ranges, input and output capabilities.
 - .4 Submit complete start-up report indicating start-up and system verification sequences.
 - .5 Submit manufacturer's written standard warranty, executed by authorized company official.
 - .6 Submit operation and maintenance data for equipment or adjustable operation parameters for incorporation into manual specified in Specifications.
-

- 1.5 SUBMITTALS
(Cont'd)
- .7 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .8 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .9 Manufacturer's Field Services: Submit reports within three days of receipt from manufacturer.

- 1.6 WASTE MANAGEMENT
AND DISPOSAL
- .1 Separate and recycle waste materials.
 - .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

- 1.7 DESIGNATED
CONTRACTOR
- .1 Hire the services of BCS Controls or it's authorized representative, to complete the work of all EMCS Sections.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Sensors: Use industry standard digital or analog signal ranges.
 - .2 Motors and Relays: Electric-electronic type, heavy duty construction, designed for industrial environment.
 - .3 There is an existing KMC System presently installed in the Building. All materials must be selected to ensure compatibility with the existing KMC system.

- 2.2 OPERATOR'S WORK
STATION
- .1 Displays:
 - .1 Update existing to Operators workstation to display all new data associated with project. (Graphic files, etc.).
-

2.3 CONTROLS

- .1 Differential Pressure Sensors:
 - .1 Differential pressure sensors with LED display.
 - .2 Heat exchanger HE-1 (both process and geo sides) (Qty: 2), Heat pumps HP-1, HP-2, HP-3 and HP-4 (both load and source sides), install within existing isolation valves (Qty: 8).
 - .3 Acceptable Product: Greystone, or approved equivalent.

- .2 Thermowell Mounted Temperature Sensor - Immersion:
 - .1 Provide thermo well mounted temperature sensors as indicated on the control drawings.
 - .2 Temperature sensors shall meet, at minimum, the following requirements:
 - .1 Rigid 6.35 mm (0.25") stainless steel probe of length, which is, at minimum, 20% of the pipe width.
 - .2 Thermistor or RTD compatible with BMS sealed in probe with three-part moisture protection system.
 - .3 BMS shall report the monitored temperature with an accuracy of 0.5°C (1.0°F).
 - .4 ABS housing with conduit entrance.
 - .5 Provide Brass or Stainless thermo well.
 - .6 Provide with thermal grease to aid temperature sensing.
 - .7 Acceptable Product: Greystone TE 200C series or approved equivalent.

- .3 Wiring:
 - .1 All wiring to run in conduit.
 - .2 Wiring must be continuous without joints.
 - .3 Refer to Electrical Division.
 - .4 All wiring installed by Departmental Representative. Final connection of all devices/equipment and programming by Contractor.

2.4 SEQUENCE OF OPERATION

- .1 The fluid cooler shall engage on EGGS temperature setpoint (user adjustable). Should the fluid cooler fail to start, an alarm shall be initiated on the EMCS.

 - .2 Should the glycol fill tank low level alarm engage, an alarm shall initiate on the EMCS and the heat pump system shall turn off.

 - .3 Create new alternate method (user selectable) of heat pump flow staging control (differential pressure). The heat pumps source side circulating pump (P-3 or P-4) shall maintain set differential pressure (user adjustable) for each stage of heat pump called upon. Domestic heat pumps HP-4 shall maintain
-

- 2.4 SEQUENCE OF OPERATION
(Cont'd)
- .3 (Cont'd)
set differential pressure (user adjustable) when called upon. An alarm shall be annunciated on the EMCS should there be a loss of flow. The heat pumps load side circulating pumps (P-5 or P-6) shall maintain set differential pressure (user adjustable) for each stage called upon; an alarm shall be annunciated on the EMCS should there be a loss of flow.
 - .4 Ensure SCADA master heat pump system shutdown scenario connected to KMC System.
 - .5 Ensure heat pump system always defaults to off position. (i.e., to avoid possible undesired equipment start-ups after power bump during plant downtimes.).

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install components to manufacturer's written instructions.
 - .2 Exposed wiring: Run in conduit or EMT.
 - .3 Run control pipe and tubing parallel to building structure. Bundle tubing together and run in ladder trays where applicable.
 - .4 All wiring and conduit installed by Contractor. Final connection of all devices/equipment and programming by Contractor.
- 3.2 VERIFICATION
- .1 Operate equipment and verify that performance criteria specified in this section has been achieved.
 - .2 Perform periodic site inspection visits by manufacturer's representative to verify that installation complies with manufacturer's instructions:
 - .1 After delivery and storage of products.
 - .2 When preparatory Work upon which product installation depends is complete.
 - .3 Twice during installation progress at 25% and 60% complete.
 - .4 After installation and cleaning is complete.
-

- 3.3 DEMONSTRATION
- .1 Demonstrate equipment to 01 79 00 - Demonstration and Training.
 - .2 Provide competent instructors to train designated personnel. Include adjustment, operation, maintenance and safety requirements of equipment and system provided, specific to this installation.
 - .3 Training Materials: Provide Training manual for trainees.
 - .4 Training Schedule: Two phases, over a 6 month period.
 - .1 Phase 1:
 - .1 Date: One day period prior to the 30 day test period.
 - .2 Duration: On the job training during the 30 day acceptance period.
 - .3 Topics: System architecture, communications, operation of computer and peripherals and detailed instruction in operator interface for control of HVAC systems, control logic for systems, and elementary preventive maintenance.
 - .2 Phase 2:
 - .1 Date: sixteen weeks after system acceptance.
 - .2 Duration: Minimum one day training
 - .3 Hardware Topics: General equipment layout, system component trouble shooting, component preventive maintenance, and maintenance and calibration of sensors and control devices.
 - .4 Software Topics: Include application programs, programming of controllers and trouble shooting and debugging system. Provide additional information necessary to respond to concerns raised by trainees during the operations period to date.
- 3.4 COMMISSIONING
- .1 Commission equipment of this section.
 - .2 Verify operation of subsystems, including field components.
 - .3 Conduct a final operational test of not less than 30 consecutive days, 24 hours per day, on the entire control system.
 - .1 Average effectiveness level (AEL): minimum 99%.
 - .2 Extend test period each day until required AEL is reached for 30 consecutive calendar days.
-

3.4 COMMISSIONING .4
(Cont'd)

Advise Departmental Representative when proper system operation is established. Departmental Representative will perform a point by point check of hardware and software items including graphics and displayed data.

- 1 GENERAL .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Specifications.
- .2 All power wiring and power disconnect to CU-1 supplied and installed by Departmental Representative. Connections of 600V power, to new fluid cooler CU-1 and 120V, 24v to CU-1 by Contractor. Controls' wiring, sensors and devices installed by Contractor. Connections to all associated controls' devices and equipment by Contractor.
- 2 REFERENCES .1 CSA-C22.1-15, Canadian Electrical Code, Part 1.
- .2 CAN/CSA C22.2 No. 0.1-M1985 (R2003), General Requirements for Double-Insulated Equipment.
- .3 CAN/CSA-C22.3 No. 1-15, Overhead Systems.
- .4 CAN3-C235-83 (R2015), Preferred Voltage Levels for AC Systems, 0 to 50 000 V.
- .5 CSA Z85-1983, Abbreviations for Electrical Terms.
- .6 EEMAC Y1-2-1979, Standard for Performance Specification for Finishing Systems for Outdoor Electrical Equipment.
- .7 EEMAC 2Y-1-1958, Standard for CEMA Light Grey Colour for Indoor Switchgear.
- 3 CODES AND STANDARDS .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Comply with CSA electrical bulletins in force at the time of tender submission, while not identified and specified by number in this Division, are to be considered as forming part of the related CSA Part II Standard.
- 4 CARE, OPERATION AND START-UP .1 Instruct operating personnel in the operation, care and maintenance of equipment.
- .2 Arrange and pay for services of manufacturer's factory service Departmental Representative to supervise start-up of installation, check, adjust, balance and calibrate components, including but not
-

- 4 CARE, OPERATION AND START-UP (Cont'd) .2 (Cont'd)
limited to overload relays, electronic soft starters, motor circuit protectors, solid state breakers, automatic transfer switch, variable frequency drives, and diesel genset.
- .3 Except where noted otherwise, 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 with all aspects of its care and operation. A minimum of three (3), one day trips, not necessarily consecutive shall be provided for each equipment type.
- 5 VOLTAGE RATINGS .1 Operating voltages: to CAN3-C235.
- .2 Motors, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- 6 PERMITS, FEES AND INSPECTION .1 The Contractor shall submit to the Electrical Inspection Department, Municipal Authority and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. This information shall be submitted within ten (10) working days of the award of Tender and the Departmental Representative is to be provided with written notice at the time this has been submitted.
- .2 The Contractor shall provide the Departmental Representative with a copy of the Electrical Inspection Department and Supply Authority Plans Review Report immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.
- .3 The Contractor shall obtain all necessary permits including an Electrical Wiring Permit for electrical work and Communications Cabling Permit for communications cabling work from the authority having jurisdiction prior to commencement of work. Provide a copy of each permit to the Departmental Representative upon receipt. The permits are to be properly displayed on the work site.
-

6 PERMITS, FEES
AND INSPECTION
(Cont'd)

- .4 Upon specific request, the Departmental Representative will provide to the Contractor, up to a maximum of three (3) copies of the drawings and specifications required for submittal to the Electrical Inspection Department and Supply Authority. These drawings and specifications will be provided to the Contractor at no cost, unless specified otherwise.
- .5 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Departmental Representative immediately upon receipt. Notify the Departmental Representative immediately of changes required by the authority having jurisdiction prior to making changes.
- .6 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of Work. Include a copy in the Operations and Maintenance Manual.
- .7 Pay all associated fees.

7 MATERIALS AND
EQUIPMENT

- .1 Provide materials and equipment in accordance with Specifications.
- .2 Equipment and material to be CSA approved or certified by an agency recognized by the local Electrical Inspection Department having jurisdiction. Where there is no alternative to supplying equipment which is not certified, obtain special approval from Electrical Inspection Department.
- .3 Factory assemble control panels and component assemblies.

8 ELECTRIC MOTORS,
EQUIPMENT AND
CONTROLS

- .1 Supplier and installer responsibility shall be coordinated with the general contractor to ensure complete and functioning systems.
 - .2 Coordinate location of mechanical equipment and associated control devices supplied by mechanical contractor. All device locations may not be necessarily shown on electrical drawings.
-

- 9 FINISHES .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel. Aluminum and stainless steel enclosures shall not be painted.
.1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
.2 Paint outdoor electrical equipment green finish to EEMAC Y1-1-1995.
- .2 Clean and touch up surfaces of existing and new shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime and paint exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- 10 FASTENERS AND EQUIPMENT MOUNTING .1 Fastening devices for all equipment and components, including bolts, nuts, washers, and screws shall be stainless steel throughout.
- 11 EQUIPMENT IDENTIFICATION .1 Identify electrical equipment with nameplates and labels.
- .2 Identification:
.1 Is to be provided with "lamicoid" nameplates as further described herein. Care is to be taken to ensure that all plates are affixed true and level, and plumb in all instances.
.2 Nameplates are to be affixed to all "metal" surfaces with steel type "pop-rivets".
.3 Nameplates are to be affixed to other types of surfaces with contact type cement.
.4 Nameplates are to be affixed to building "exterior" surfaces with nylon inserts and self tapping screws unless specifically indicated otherwise.
.5 Contact type cement is to be applied (battered) to complete rear side of plate, as opposed to several locations or areas on same.
.6 Lamicoid nameplates installed on disconnect switches shall contain the following information:
.1 Designated name of equipment or equipment being fed, whichever is applicable.
.2 Designated name of power source.
.3 Branch circuit breaker number(s) where possible.
.4 Voltage(s) and phase.i.e.: EXHAUST FAN NO. 5 SUPPLY FAN NO. 3 PANEL H - CKT. 17 M.C.C. NO. 1 120V - 1 PH 600V - 3 PH
-

11 EQUIPMENT
IDENTIFICATION
(Cont'd)

- .2 Identification:(Cont'd)
- .7 Lamicoid nameplates are to be installed on all junction and/or pull boxes sized 150 mm x 150 mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.
- .8 Lamicoid nameplates are to be installed adjacent to each overcurrent device located in switchboards, CDP panels, etc. They need only indicate designated name and/or number of equipment they feed. Unused O.C. devices are to be identified as spare(s).
- .9 Allow for an "average" of 40 letters for each lamicoid nameplate.
- .1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, for all electrical systems except fire alarm systems which shall have red face with white core.
- .2 1.5 mm thick nameplates above receptacles as previously indicated, with top left and right corners to be rounded off.
- .3 Lettering on lamicoid nameplates shall not "start", nor "end" nearer than 9 mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates shall be as indicated in the following chart.

NAMEPLATE SIZES

Size 1	10mm x 50mm	1 line	5mm high letters
Size 2	13mm x 75mm	1 line	6mm high letters
Size 3	19mm x 75mm	2 lines	5mm high letters
Size 4	19mm x 90mm	1 line	10mm high letters
Size 5	50mm x 90mm	2 lines	19mm high letters
Size 6	25mm x 100mm	1 line	19mm high letters
Size 7	25mm x 100mm	2 lines	6mm high letters
Size 8	50mm x 150mm	2 lines	19mm high letters
Size 9	50mm x 90mm	3 lines	10mm high letters

- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Identification to be English.
- .5 Co-ordinate names of equipment and systems with other trades to ensure that equipment identification is consistent.
- .6 In addition to required nameplates and colour coding, junction boxes to have the panel and circuit numbers of all wiring contained within listed on the coverplate. List to be written using black indelible marker.

11 EQUIPMENT
IDENTIFICATION
(Cont'd)

- .7 Identification of electrical junction boxes and pull boxes:
 - .1 Apply colour coding prior to pulling conductors into boxes.
 - .2 Where primary colour only is indicated:
 - .1 Colour inside of box.
 - .2 Colour all cover plates.
 - .3 Where primary and secondary colours are indicated:
 - .1 Paint inside of box with the primary colour.
 - .2 Diagonally apply to each half of the cover plate the primary and secondary colours.
- .8 Provide clearly visible marking on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.
- .9 Terminal boxes, panels and miscellaneous equipment fed from two or more sources shall be provided with a warning nameplate prominently displayed: "CAUTION - MORE THAN ONE SOURCE VOLTAGE".
- .10 Terminal boxes, panels and miscellaneous wire ways containing intrinsically safe circuits shall be provided with a warning, nameplate prominently displayed: "INTRINSICALLY SAFE CIRCUIT".

12 WIRING
IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Panduit PLD-1 and PLD-2 or approved equivalent.
 - .2 Maintain phase sequence and colour coding throughout.
 - .3 Colour code: to CSA C22.1.
 - .4 Use colour coded wires in communication cables, matched throughout system.
 - .5 Indicate panel and conduit number on all phase conductors (i.e., Panel A, ckt 3) at the device and at any intermediate junction/pull boxes.
-

- 12 WIRING IDENTIFICATION (Cont'd)
- .6 Identify all neutral conductors to indicate the phase conductor with which they are associated and at any intermediate junction/pull boxes.
 - .7 Indicate MCC designation and section number or field mounted motor starter on all phase conductors at the device.
- 13 CONDUIT AND CABLE IDENTIFICATION
- .1 For power cables to electrical equipment, indicate designated name of equipment and designated name of power source (i.e., Fuel Pump #1 - fed from MCC #1).
 - .2 Where more than one cable terminates at a device, add cable number (i.e., -1, -2) to end of cable identification.
 - .3 Use Electrovert PVC K-marker complete with PVC carrier strip and self-locking nylon cable ties (black) or approved equal.
- 14 WIRING TERMINATIONS
- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- 15 MANUFACTURERS AND CSA LABELS
- .1 Visible and legible after equipment is installed.
- 16 WARNING SIGNS
- .1 As specified and to meet requirements of Electrical Inspection Department.
 - .2 Decal signs, minimum size 180 mm x 250 mm.
- 17 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: 1350 mm (54").
-

18 CONDUIT AND
CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Arrange and pay for holes through exterior walls; provide flashings and make weatherproof.

19 FIRESTOPPING

- .1 Contractor to provide complete firestopping and smoke sealing of all cable, cabletrough and conduit penetrations through fire resistant separations in accordance with specification.

20 FIELD QUALITY
CONTROL

- .1 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .2 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.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 Submit test results for Departmental Representative's review and approval.

21 QUALITY
ASSURANCE

- .1 Instructions:
 - .1 Interferences: electrical drawings are generally of a diagrammatic nature. Except where dimensioned locations are shown, plan and coordinate the work to eliminate interferences with other trades. Provide all necessary raceway offsets, fittings, and boxes, adjust all fixture and equipment boxes, adjust all fixture and equipment locations and provide all supporting materials required for a planned, coordinated and neat installation. Where interferences occur, the Departmental Representative's authorized representative will decide which item must be relocated regardless of which was installed first.
-

21 QUALITY
ASSURANCE
(Cont'd)

- .1 Instructions: (Cont'd)
 - .2 Electrical workmanship: provide workmanship of the highest quality. Sub-standard work will not be accepted. Use only persons skilled in the trades involved.
 - .3 Electrical materials: provide all materials used in this work, unless particularly specified otherwise, that are new, free from flaws, or imperfections.
 - .4 Sleeves and inserts: furnish and locate all sleeves and inserts required for this work in accordance with drawings.

- .2 Applicable standards:
 - .1 All electrical work shall conform with the requirements and recommendations of the latest edition of the Canadian Electrical Code and all local codes and ordinances. In conflicts between codes, the more stringent requirements shall govern.
 - .2 In no instance shall the standard established by this specification be reduced by any of the codes or standards referred to in this specification.
 - .3 Standards: the specifications and standards of the following organizations are by reference made as part of these specifications and all electrical work, unless otherwise indicated, shall comply with their requirements and recommendations wherever applicable.
 - .4 Canadian Standard Association (CSA).
 - .5 Illuminating Consultants Society (I.E.S.).
 - .6 Institute of Electrical Electronic Consultants (I.E.E.E.).
 - .7 Instrument Society of America (I.S.A.).
 - .8 American Society for Testing Materials (A.S.T.M.).
 - .9 Certified Ballast Manufacturers (C.B.M.).
 - .10 Insulated Power Cable Consultants Association (I.P.C.E.A.).
 - .11 Electrical Equipment Manufacturer's Association of Canada (E.E.M.A.C.).
 - .12 National Fire Protection Association (N.F.P.A.).
 - .13 Underwriter's Laboratories of Canada (U.L.C.).
 - .14 Joint Industrial Council (J.I.C.).
 - .15 All local and provincial codes and ordinances.

22 RECORD
DRAWINGS

- .1 Record Drawings:
 - .1 After award of Contract, Departmental Representative will provide a set of transparency drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditons and changes ordered by.
-

- 22 RECORD DRAWINGS (Cont'd)
- .2 Applicable standards: (Cont'd)
- .1 (Cont'd)
- .1 (Cont'd)
- Departmental Representative . 2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Departmental Representative.
- .2 On completion of Work and prior to final inspection, submit record documents to. Departmental Representative.
- .3 Refer to Division 1 for more details.
- 23 WASTE MANAGEMENT AND DISPOSAL
- .1 Separate and recycle waste materials in accordance with applicable Construction/Demolition Waste Management And Disposal Regulations.
- .2 Refer to Specifications.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 117-13, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422-63-2007, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
 - .5 ASTM D 1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m³).
 - .6 ASTM D 4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .2 CSA-A3001-13, Cementitious Materials for Use in Concrete.
 - .3 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- 1.2 DEFINITIONS
- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock : solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
 - .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
-

1.2 DEFINITIONS
(Cont'd)

- .3 Topsoil:
.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
.1 Weak, chemically unstable, and compressible materials.
.2 Frost susceptible materials:
.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
.2 Table:
- | Sieve Designation | % Passing |
|-------------------|-----------|
| 2.00 mm | 100 |
| 0.10 mm | 45 - 100 |
| 0.02 mm | 10 - 80 |
| 0.005 mm | 0 - 45 |
- .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Make submittals in accordance with Specifications.

1.5 EXISTING
CONDITIONS
(Cont'd)

- .1 (Cont'd)
- .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, notify Departmental Representative or authorities having jurisdiction establish location and state of use of buried utilities and structures. Departmental Representative or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful test excavations.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
- .1 Conduct condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative at no additional cost.
 - .3 Where required for excavation, cut roots or branches as approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: to Division 3 of Province of Nova Scotia Department of Transportation Standard Specifications, Metric Edition.

Sieve Designation	% Passing	
	Type 1	Type 2
80 mm	-	100
56 mm	-	70-100
28 mm	-	50-80
20 mm	100	-
14 mm	50-85	35-65

2.1 MATERIALS .1 (Cont'd)
(Cont'd)

Sieve Designation	% Passing	
5mm	20-50	20-50
0.160 mm	5-12	5-12
0.08mm	3-5	3-5

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 100 mm, cinders, ashes, sods, refuse or other deleterious materials. Having a maximum of 5% fines passing the 0.08mm sieve.
- .3 Unshrinkable fill: proportioned and mixed to provide:
- .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum cement content of 25 kg/m³ with 40% fly ash replacement: to CSA-A3001, Type GU.
 - .3 Minimum strength of 0.07MPa at 24 h.
 - .4 Concrete aggregates: to CSA-A23.1/A23.2.
 - .5 Cement: Type GU.
 - .6 Slump: 160 to 200 mm.

PART 3 - EXECUTION

3.1 TEMPORARY
EROSION AND
SEDIMENTATION
CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE
PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3
PREPARATION/
PROTECTION

- .1 Protect existing features from drainage and in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF
TOPSOIL

- .1 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses, and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative.
 - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil off site.

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.1 Stockpile granular materials in manner to prevent segregation.
 - .2 Protect fill materials from contamination.
-

- 3.5 STOCKPILING
(Cont'd)
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.
- 3.6 COFFERDAMS,
SHORING, BRACING
AND UNDERPINNING
- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Nova Scotia.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as approved by Departmental Representative.
- .4 During backfill operation:
.1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
.2 Do not remove bracing until backfilling has reached respective levels of such bracing.
.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .6 Upon completion of substructure construction:
.1 Remove cofferdams, shoring and bracing.
.2 Remove excess materials from site and restore watercourses as approved by Departmental Representative.
- 3.7 DEWATERING AND
HEAVE PREVENTION
- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
-

3.7 DEWATERING AND
HEAVE PREVENTION
(Cont'd)

- .5 Dispose of water in manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.8 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
 - .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation off site.
 - .3 Excavation must not interfere with bearing capacity of adjacent foundations.
 - .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
 - .5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
 - .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by. Departmental Representative.
 - .7 Restrict vehicle operations directly adjacent to open trenches.
 - .8 Dispose of surplus and unsuitable excavated material off site
 - .9 Do not obstruct flow of surface drainage or natural watercourses.
 - .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
 - .11 Notify Departmental Representative when bottom of excavation is reached.
 - .12 Obtain Departmental Representative approval of completed excavation.
 - .13 Remove unsuitable material from trench bottom including those that extend below required elevations
-

3.8 EXCAVATION
(Cont'd)

- .13 (Cont'd)
to extent and depth as directed by Departmental Representative.
- .14 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with, concrete specified for footings, fill concrete or Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density. As directed by Departmental Representative.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .15 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density to undisturbed soil as minimum.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.9 FILL TYPES AND
COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698 ASTM D 1557.
 - .1 Exterior side of perimeter walls: use Type 2 fill to subgrade level. Compact to 100% of corrected maximum dry density.
 - .2 Within building area: use Type 3 to underside of base course for floor slabs. Compact to 100% of corrected maximum dry density.
 - .3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.
 - .4 Under footings: use Type 3 fill to underside of 150 mm required Type 1 gravel. Compact Type 1 and Type 3 to 100% of corrected medium dry density
 - .5 Under concrete walks and asphalt to subgrade level. Use Type 3 fill, compact to 100% of corrected maximum dry density
 - .6 Under sodded area use Type 3 fill to topsoil level. Compact to 95% corrected maximum dry density.
 - .7 Place unshrinkable fill in areas as indicated.
-

3.10 BEDDING AND
SURROUND OF
UNDERGROUND

- .1 Place and compact granular material for bedding and surround of underground services as indicated on the drawings and as indicated in subsection 3.2.
- .2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
 - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .3 Do not use backfill material which is frozen or contains ice, snow or debris.
 - .4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
 - .5 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 600m.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative or:
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
-

3.11 BACKFILLING
(Cont'd)

- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Install drainage system in backfill as indicated by Departmental Representative.

3.12 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as directed by Departmental Representative.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstall areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.