SPECIFICATIONS

Division 09

Division 13

Division 15

Division 17

Division 21

Division 22

Division 23

Division 26

Division 01

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises general construction of the new water treatment system, located at Arviat, Nunavut; and further identified as:

- .1 Construction of steel skid foundation for the water treatment building.
- .2 Supply and construction of new building envelope of the water treatment plant.
- .3 Supply and installation of water treatment plant including cartridge filtration system and chlorination system.
- .4 Supply and installation of mechanical, electrical and control and instrumentation systems.
- .5 Supply and installation of heating system and air handling systems.
- .6 Commissioning and training of all equipment and systems.
- .7 Provision for supply of the Operation and Maintenance Manuals.
- .8 Provision for supply of all bonding and insurance.

1.2 CONTRACT METHOD

.1 Construct Work under single, stipulated price contract.

1.3 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Engineer.

.2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Engineer, in writing, any defects which may interfere with proper execution of Work.

1.4 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Completion.

.2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.5 EXISTING SERVICES

.1 Notify Engineer and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Engineer five (5) days notice for necessary interruption of mechanical or electrical service throughout course of work.

.3 Submit schedule to and obtain approval from Engineer for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Engineer and confirm findings in writing.

.5 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.6 Record locations of maintained, re-routed and abandoned service lines.

.7 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

.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. Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: An element of Work performed during course of Project. An activity normally has an expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): A 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 complete an activity or other Project element, usually expressed as workdays or workweeks.

.6 Master Plan: A summary-level schedule that identifies major activities and key milestones.

.7 Milestone: A significant event in Project, usually completion of major deliverable.

.8 Project Schedule: The planned dates for performing activities and the planned dates for meeting milestones. A 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 Engineer to enable monitoring of project work in relation to established milestones.

1.2 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 ten (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.

1.3 SUBMITTALS

.1 Submit to Engineer within seven (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 Engineer within five (5) working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.1 Building and supplies to be mobilized on the 2008 sea lift.

.2 Site works to be completed by September 15, 2008.

.3 Interim Certificate (Substantial Completion) by December 1, 2008.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Engineer will review and return revised schedules within five (5) working days.

.3 Revise impractical schedule and resubmit within five (5) working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 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 Shop Drawings, Samples.

.3 Permits.

.4 Mobilization.

.5 Road works.

.6 Intake line

.7 Building pad

.8 Power line and Phone Line

.9 Building module.

.10 Plumbing.

.11 Lighting.

.12 Electrical.
.13 Piping.
.14 Controls.
.15 Heating, Ventilating, and Air Conditioning.
.16 Millwork.
.17 Testing and Commissioning.
.18 Supplied equipment long delivery items.
.19 O&M Manuals
.20 Record Drawings
.21 Substantial completion
.22 Final Completion.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on monthly 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 forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 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.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Administrative.

.2 Shop drawings, product data, samples and mock-ups.

.3 Progress Photographs.

.4 Certificates and transcripts.

1.2 Related Sections

.1 Section 01 32 18 - Construction Progress Schedule – Gantt Chart.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 01 79 00 - Demonstration and Training.

1.3 Administrative

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

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

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

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

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

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer’s review of submittals.

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

.10 Keep one reviewed copy of each submission on site.

1.4 Shop Drawings

.1 The term "Shop Drawings" shall mean any of the following:

.1 Original drawings or modified standard drawing prepared by Contractor or any of subcontractors or equipment suppliers.

.2 Manufacturer's catalogue sheets, brochures, literature, performance charts and diagrams and similar documentation used to illustrate manufactured products.

.2 Shop drawings shall clearly indicate details of construction of Work, including:

.1 Layout showing dimensions including identified field dimensions and clearances;

.2 Setting or erection details;

.3 Capacities, and;

.4 Performance characteristics.

.3 Accompany submission(s) with transmittal letter containing:

.1 Date;

.2 Project title and number;

.3 Contractor's name and address, and subcontractor (if applicable);

.4 Identification and quantity of each shop drawing, product data and sample;

.5 Name, address and telephone number(s) of supplier and manufacturer, and;

.6 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.4 Submit a minimum of three (3) copies of all shop drawings. After review, Engineer will distribute:

.1 Two (2) copies to Engineer's files.

.2 One (1) copy to be returned to Contractor for inclusion in O&M Manuals.

.3 Submissions of Shop Drawings to Contractor are intended to supplement O&M Manual and are not the sole intent of the six (6) copies. Data and information provided in O&M Manual shall conform to the requirements in Section 01 78 00 - Closeout Submittals.

1.5 Progress Photographs

.1 Provide a digital copy photos.

.2 Viewpoints: Interior and exterior, viewpoints determined by Engineer.

.3 Frequency: Monthly with progress statement.

.2 For O&M Manual, provide six (6) copies of construction photos on 8½ x 11 sheets, four per page, total 50 pictures in color.

1.6 Certificates and Transcripts

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 41 00 - Regulatory Requirements.

.3 Section 02 61 33 - Hazardous Materials.

1.2 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

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

.1 Material Safety Data Sheets (MSDS).

.3 Northwest Territories and Nunavut

.1 Safety Act, R.S.N.W.T. [1988].

1.3 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.4 Submit copies of incident and accident reports.

.5 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.

.6 Engineer will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five (5) working days after receipt of plan. Revise plan as appropriate and resubmit plan to Engineer within five (5) working days after receipt of comments from Engineer.

.7 Engineer'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.

.8 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Engineer.

1.4 FILING OF NOTICE

.1 File Notice of Project with Territorial authorities prior to beginning of Work.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Engineer prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.8 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Engineer may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

.1 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 conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Safety Act, General Safety Regulations, R.R.N.W.T.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Territory of the Northwest Territories having jurisdiction and advise Engineer verbally and in writing.

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 Territory of Nunavut having jurisdiction, and in consultation with Engineer.

1.13 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Engineer.

.2 Provide Engineer with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Engineer may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Engineer.

.2 Do blasting operations in accordance with Section 31 23 17 - Rock Removal.

1.15 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Engineer.

1.16 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: Presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: Prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 SUBMITTALS

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

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Engineer. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction task(s).

.4 Environmental protection plan: include:

- .1 Name(s) of person(s) responsible for ensuring adherence to Environmental Protection Plan.
- .2 Name(s) and qualifications of person(s) responsible for training site personnel.
- .3 Descriptions of environmental protection personnel training program.
- .4 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Department of Fisheries and Oceans (DFO). The plan will specifically address the intake installation and the control of sediment from the job site to the fresh water lakes.
- .5 Drawings showing locations of proposed temporary material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .7 Spill Control Plan: Including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.9 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, territorial, and Municipal laws and regulations for storage and handling of these materials.

.10 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters, including chlorinated water, which are directly derived from construction activities, such as clean-up water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.3 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.4 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site unless approved by Engineer.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.5 DRAINAGE

.1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Do not pump water containing suspended materials into waterways.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements and DFO.

1.6 WORK ADJACENT TO WATERWAYS

.1 Do not use waterway beds for borrow material without Engineer's approval.

.2 Do not dump un authorized fill, or waste material or debris in waterways.

.3 Design and construct temporary crossings to minimize erosion to waterways.

1.7 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.8 NOTIFICATION

.1 Engineer will notify Contractor in writing of observed non-compliance with Federal, Territorial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan. Contractor: after receipt of such notice, inform Engineer of proposed corrective action and take such action for approval by Engineer.

.2 Engineer will issue stop order of work until satisfactory corrective action has been taken.

.3 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents as follows:

.1 Nunavut Public Health Act.

.2 Municipal Bylaws.

.3 Canadian Standards Association (CSA).

.4 Public Drinking Water Supply Regulations (GN).

.5 Department of Fisheries and Oceans (DFO).

.6 Guidelines for Canadian Drinking Water Quality (GCDWQ), Health Canada.

.7 National Fire Code.

.8 National Plumbing Code.

1.2 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 21 00 – Allowances.

.2 Section 01 33 00 – Submittal Procedures.

1.2 INSPECTION

.1 Allow Engineer access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Engineer instructions, or law of Place of Work.

.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 Engineer 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, Engineer shall pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Engineer for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Engineer.

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

.3 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 Engineer at no cost to Engineer. Pay costs for retesting and re-inspection.

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 appropriate agency and Engineer 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 Engineer 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 Engineer it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner 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 Engineer.

1.7 REPORTS

.1 Submit two (2) copies of inspection and test reports to Engineer.

1.8 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.9 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 52 00 – Construction Facilities.

.2 Section 01 56 00 – Temporary Barriers and Enclosures.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 DEWATERING

.1 Provide temporary drainage to keep excavations and site free from standing water.

1.4 WATER SUPPLY

.1 Pay for utility charges at prevailing rates.

1.5 TEMPORARY HEATING AND VENTILATION

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

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

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

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

.4 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.

.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

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

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

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

.8 Pay costs for maintaining temporary heat, when using permanent heating system.

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

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

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

1.6 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.3 Provide and maintain temporary lighting throughout project.

.4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Engineer provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.7 FIRE PROTECTION

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 51 00 – Temporary Utilities.

.2 Section 01 56 00 – Temporary Barriers and Enclosures.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CAN3-A23.1-/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.

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

.4 CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

1.3 INSTALLATION AND REMOVAL

.1 Identify areas which have to be gravelled to prevent tracking of mud.

.2 Indicate use of supplemental or other staging area.

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

.4 Remove from site all such work after use.

1.4 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA- S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.

1.5 SITE STORAGE/LOADING

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

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

1.6 SECURITY

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

1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.8 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.

1.9 CONSTRUCTION SIGNAGE

.1 Provide and erect project sign, within three (3) weeks of signing Contract, in a location designated by Engineer.

.2 Construction sign 2.4 x 1.2 m, of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.

.3 Owner will supply sign FOB in Yellowknife. Contract to pay for mobilization of sign to site..

.4 No other signs or advertisements, other than warning signs, are permitted on site.

.5 Provide project identification site sign comprising foundation, framing, and one 1200 x 2400 mm signboard as detailed and as described below.

.1 Foundations: 15 MPa concrete to CAN/CSA-A23.1 minimum 200 mm x 900 mm deep. Framework and battens: SPF, pressure treated minimum 89 x 89 mm.

.6 Locate project identification sign as directed by Engineer and construct as follows:

.1 Build concrete foundation, erect framework, and attach signboard to framing.

.7 Direct requests for approval to erect Consultant/Contractor signboard to Engineer. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.

.8 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN3-Z321.

.9 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 Engineer.

1.10 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 51 00 – Temporary Utilities.

.2 Section 01 52 00 – Construction Facilities.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978(R2003), Douglas Fir Plywood.

1.3 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, and open ice areas.

1.5 WEATHER ENCLOSURES

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

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

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

1.6 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards.

.2 If there is question as to whether products or systems are in conformance with applicable standards, Engineer reserves right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be born by Engineer in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 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. Should disputes arise as to quality or fitness of products, decision rests strictly with Engineer based upon requirements of Contract Documents.

.3 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.4 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 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 Engineer 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 Engineer at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Engineer reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 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 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.

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

.6 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

1.6 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.

.2 Notify Engineer in writing, of conflicts between specifications and manufacturer's instructions, so that Engineer will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Engineer to require removal and re-installation at no increase in Contract Price or Contract Time.

.4 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Engineer if required Work is such as to make it impractical to produce required results.

.5 Do not employ anyone unskilled in their required duties. Engineer reserves right to require dismissal from site, workers deemed incompetent or careless.

.6 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Engineer, whose decision is final.

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 where indicated otherwise.

.2 Before installation inform Engineer if there is interference. Install as directed by Engineer.

1.9 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Engineer of conflicting installation. Install as directed.

1.11 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.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.

1.12 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. 304 stainless steel for exterior areas.

.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 stainless steel.

1.13 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 Engineer.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Field engineering survey services to measure and stake site.

.2 Survey services to establish and confirm inverts for Work.

.3 Recording of subsurface conditions found.

1.2 RELATED SECTIONS

.1 Section 01 32 18 – Construction Progress Schedules- Bar (GANNT) Chart.

1.3 REFERENCES

.1 Owner's identification of existing survey control points and property limits.

1.4 QUALIFICATIONS OF SURVEYOR

.1 Qualified surveyor shall be acceptable to Engineer.

1.5 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Engineer.

.4 Report to Engineer when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.6 SURVEY REQUIREMENTS

.1 Establish lines and levels, locate and lay out, by instrumentation.

.1 Establish lines and levels, locate and lay out, by instrumentation.

.2 Stake for grading, and fill placement.

.3 Stake slopes.

.4 Establish pipe invert elevations.

.5 Establish foundation and floor elevations.

.6 Establish lines and levels for mechanical and electrical work.

1.7 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures 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 Engineer of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Engineer.

1.8 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.9 SUBMITTALS

.1 Submit name and address of Surveyor to Engineer.

.2 On request of Engineer, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform to Contract Documents.

1.10 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Consultant determine that conditions do differ materially; instructions will be issued for changes in Work as provided in Changes and Change Orders.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

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

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.

.3 Include in request:

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

1.2 MATERIALS

.1 Required for original installation.

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

1.3 PREPARATION

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

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

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

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

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

1.4 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

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

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

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

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

.9 Restore work with new products in accordance with requirements of Contract Documents.

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

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site, unless approved by Engineer.

.3 Clear snow and ice from access to building. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide on-site containers for collection of waste materials and debris.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Dispose of waste materials and debris in accordance to the hamlet requirements.

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

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

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

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

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

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Engineer. Do not burn waste materials on site, unless approved by Engineer.

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

.7 Clean and polish hardware, stainless steel, chrome, and mechanical and electrical fixtures.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.13 Remove dirt and other disfiguration from exterior surfaces.

.14 Clean and sweep roofs.

.15 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.

.16 Remove snow and ice from access to building.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

.1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 Related Sections

.1 Section 01 78 00 - Closeout Submittals.

.2 Section 01 91 13 - General Commissioning (Cx) Requirements.

1.3 Inspection and Declaration

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Engineer's Inspection at least 5 days in advance of inspection.

.2 Substantial Completion Inspection: Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Substantial Completion: Submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Operation of systems has been demonstrated to Owner's personnel.

.5 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by Owner, Engineer and Contractor. If Work is deemed incomplete by Owner and Engineer, complete outstanding items and request re-inspection.

.5 Declaration of Final Completion: When Owner and Engineer consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Final Completion.

.6 Commencement of Warranty Periods: Date of Owner's acceptance of submitted declaration of Substantial Completion shall be date for commencement for warranty period, refer to GC 31.

.7 At time of hand over, change all door locks and provide Engineer with ten (10) sets of keys.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 77 00 - Closeout Procedures.

.4 Section 01 79 00 - Demonstration and Training.

.5 Section 01 91 13 - General Commissioning (Cx) Requirements.

1.3 SUBMISSION - OPERATIONS AND MAINTENANCE MANUAL

.1 Operations and Maintenance Manuals for the project will be produced by the Contractor.

.2 Manuals are to cover all installed items requiring or likely to require operating, maintenance, or repairs.

.3 The Contractor's work includes: the complete authoring, organization, and supply of O&M manual material as detailed in this section.

.4 All work described in this section is the Contractor's work except where specifically indicated otherwise.

.5 The number of copies required is six (6).

.6 The draft Operation and Maintenance manual is to be submitted for review by the Engineer a minimum of four (4) weeks prior to requesting Substantial Completion.

.7 The final approved and completed Operation and Maintenance Manuals are to be delivered to the Engineer at least 14 days before the Substantial Completion inspection. The data is to be separated into individual manual sets, organized into applicable

categories of work parallel to the specification sections and each chapter in order and identified.

1.4 REFERENCE STANDARDS

.1 The Contractor's Operation and Maintenance manual submissions are to conform to the current edition of "Specifications for Operations and Maintenance Manuals", Department of Public Works and Services, Government of Northwest Territories. (Appended)

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

.3 Copy will be returned with Engineer's comments.

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

.5 Four (4) weeks prior to Substantial Performance of the Work, submit to the Engineer, one draft copy of Operation and Maintenance (O&M) Manuals in English.

.6 Pay costs of transportation.

1.5 FORMAT

.1 The provision of Binders and Dividers are the responsibility of the Contractor.

.2 The completed manual will contain 10 chapters. The responsibility for production of each chapter is indicated below:

.1 Introduction (by Consultant)

.2 Index (by Contractor)

.3 Background, Design Data (by Consultant)

.4 Schematic, Functional Data (by Consultant)

.5 Components Details (by Contractor)

.6 Operating Procedures (by Contractor)

.7 Maintenance Procedures (by Contractor)

.8 Testing and Certification Data (by Contractor)

.9 Manufacturer Data and Service Information (by Contractor)

.10 Appendices (by Contractor)

.3 Group information logically by system within chapters to the greatest possible extent. Organize the information on each system in the most logical fashion, for example, from supply point through to point of use.

.4 Organize data in the form of an instructional manual.

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

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

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

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

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

.10 Text: Manufacturer's printed data, or typewritten data.

.11 Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.12 Provide 1:1 scaled CAD files in dwg format on CD.

1.6 TESTING AND CERTIFICATION DATA (CHAPTER 8)

.1 Provide data sheets that provide actual operating conditions after the systems have been balanced or adjusted to design conditions. Data required includes field check data on all motors including rpm, voltage, phase, and actual current under normal loads.

.2 Include all data sheets recording concrete test results, data tests for leakage, drain operation, ground test, pump capacity tests, etc.

.3 List all items that require periodic inspection by independent inspectors. List the frequency of inspection, the inspection agency to contact, including address and current phone number.

.4 Include a photocopy of each certificate issued by the independent inspectors who make inspections pursuant to health, safety, and other regulations of a similar nature. Indicate where the original of each such certificate is filed and where it is to remain displayed.

.5 Include the originals of manufacturer's warranties and certificates issued by the independent inspectors in Copy 1 of the manual.

.6 Include clear, legible photocopies of manufacturers' warranties and certificates issued by the independent inspectors in copies 2 through 6.

.7 Group warranties together to form a section in Chapter 8.

1.7 MANUFACTURER'S INFORMATION (CHAPTER 9)

.1 This chapter of the Operation and Maintenance manual provides a collection of all manufacturer's service manuals, parts lists, operating and maintenance instructions, performance curves, and other applicable data that may be required in future years.

.2 Include information needed for operation, maintenance and repair of every component of mechanical and electrical systems, and any other system requiring or likely to require operation or routine maintenance.

.3 Preface this section with an index. List in order each item by the manufacturer's name and the pieces of equipment to which it refers. Include supplier's name, address, and phone number.

.4 Include:

.1 Maintenance instructions for finished surface and materials.

.5 Include all service manuals, data sheets, and other manufacturer's information for each component.

.6 Manufacturer's information is to be original in all copies of the manual. Photocopies are not acceptable.

.7 On the first page of each inclusion, identify the piece of equipment to which it refers. Include nameplate information such as model, size, capacity, serial number, etc.

.8 Remove pages from manufacturer's information that are irrelevant to the equipment provided to this project.

.9 Where tables and curves are given for the full range of sizes, underline in red in all copies the data that refers to the installed equipment. If more than one size or type in the same table was used, add the identification for each in the margin to assist positive identification. Draw a thick diagonal black line across all data not applicable to equipment provided.

.10 If any warning instructions are included which, if ignored, could significantly affect the equipment, mark these with red arrows in all copies, to draw to the operator's attention.

.11 Service manuals must be the operating and maintenance type, which gives parts lists, preferably including an exposed or sectioned drawing for guidance in assembling, installation details, lubrication, and operations details. Sales types of brochures, which give only a very general description and few details, are not acceptable.

.12 Mount any items that are smaller than 8½"x 11", on a full page, for inclusion in the manual.

.13 Include all wiring diagrams complete with wire coding.

1.8 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Engineer and Owner, one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

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

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

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

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

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

.5 Keep record documents and samples available for inspection by Engineer.

1.9 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of blue line opaque drawings, and in copy of Project Manual, provided by Engineer.

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

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

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

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

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

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

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

1.10 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: Include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting

conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

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

.3 Include installed color coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed color 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 and balancing reports as specified in Section 01 45 00 - Quality Control and Section 01 81 00 - Commissioning.

.15 Additional requirements: As specified in individual specification sections.

1.11 MATERIALS AND FINISHES

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

1.12 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections and in accordance to Section 17 00 00 - Spare Parts.

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

.3 Deliver to site; place and store.

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

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

1.13 MAINTENANCE MATERIALS

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

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

.3 Deliver to site; place and store.

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

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

1.14 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 all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

1.15 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

1.16 WARRANTIES AND BONDS

.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 (10) days after completion of the applicable item of work.

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

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

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 77 00 – Closeout Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements

.3 Section 01 91 31 – Commissioning (Cx) Plan

.4 Section 01 91 33 – Commissioning (Cx) Forms

.5 Section 01 91 41 – Commissioning (Cx) Training

1.2 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two (2) weeks prior to date of final inspection.

.2 Provide 20 days written notification prior to the start of the demonstration and training.

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

1.3 QUALITY CONTROL

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

1.4 SUBMITTALS

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

.2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

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

1.5 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements and Section 01 91 31 – Commissioning Plan.

.2 Testing, adjusting, and balancing have been performed in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements and equipment and systems are fully operational.

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

1.6 PREPARATION

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

.2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

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

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

.1 AFD - Alternate Forms of Delivery, service provider.
.2 BMM - Building Management Manual.
.3 Cx - Commissioning.
.4 EMCS - Energy Monitoring and Control Systems.
.5 O&M - Operation and Maintenance.
.6 PI - Product Information.
.7 PV - Performance Verification.
.8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
.2 Ensure appropriate documentation is compiled into the BMM.
.3 Effectively train O&M staff.

.2 Contractor leads the Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: As per client's requirements or determined by designer. To meet Project functional and operational requirements.

.4 AFD managed projects the term Engineer in Cx specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 31 - Commissioning (Cx) Plan.

.2 For Cx responsibilities, refer to Section 01 91 31 - Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.

.6 Engineer will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Engineer.

.2 Equipment, components and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the un-functional system, including related systems as deemed required by Engineer, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Engineer.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before Start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Engineer.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems; submit TAB reports to Engineer for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Engineer in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Engineer before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

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

.1 Submit no later than four (4) weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Engineer for changes to submittals and obtain written approval at least eight (8) weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Engineer where not specified and obtain written approval at least eight (8) weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Engineer.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

.2 Engineer to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Engineer.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings: Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart and as specified herein.

.2 Purpose: To resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At [60]% construction completion stage. Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart. Engineer to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Engineer, who will record and distribute minutes.

.7 Ensure subcontractors and relevant manufacturer representatives are present at [60]% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide twenty (20) days notice prior to commencement.

.2 Engineer to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Factory testing: Manufacturer to:

- .1 Coordinate time and location of testing.
- .2 Provide testing documentation for approval by Engineer.
- .3 Arrange for Engineer to witness tests.
- .4 Obtain written approval of test results and documentation from Engineer before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Engineer.

- .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
- .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

- .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
- .2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

- .1 Experienced in design, installation and operation of equipment and systems.
- .2 Ability to interpret test results accurately.
- .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

- .1 Included in delivery and installation:
  - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
  - .2 Visual inspection of quality of installation.
- .2 Start-up: Follow accepted start-up procedures.
- .3 Operational testing: Document equipment performance.
- .4 System PV: Include repetition of tests after correcting deficiencies.
- .5 Post-substantial performance verification: To include fine-tuning.

.3 Correct deficiencies and obtain approval from Engineer after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Engineer. If results reveal that equipment start-up

was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Engineer.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Engineer.

.3 If evaluation report concludes that major damage has occurred, Engineer shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Engineer for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Engineer to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Engineer for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify Engineer at least twenty (20) days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

.1 Submit to Engineer for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 2-way radios.

.2 Ladders.

.3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.21 WITNESSING COMMISSIONING

.1 Engineer to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Engineer within five (5) working days of test and with Cx report.

1.23 EXTRAPOLATION OF RESULTS

.1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Engineer in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.24 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.25 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Engineer.

.2 Report problems, faults or defects affecting Cx to Engineer in writing. Stop Cx until problems are rectified. Proceed with written approval from Engineer.

1.26 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Engineer.

1.27 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.28 TRAINING

.1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.29 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.30 OCCUPANCY

.1 Cooperate fully with Engineer during stages of acceptance and occupancy of facility.

1.31 INSTALLED INSTRUMENTATION

.1 Use instruments installed under Contract for TAB and PV if:

.1 Accuracy complies with these specifications.

.2 Calibration certificates have been deposited with Engineer.

.2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.32 PERFORMANCE VERIFICATION TOLERANCES

.1 Application tolerances:

.1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

.2 Instrument accuracy tolerances:

.1 To be of higher order of magnitude than equipment or system being tested.

.3 Measurement tolerances during verification:

.1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.33 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Engineer will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

.2 Related Sections:

.1 Section 01 91 13. - General Commissioning (Cx) Requirements

1.2 REFERENCES

.1 American Water Works Association (AWWA)

.2 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

.1 Provide a fully functional facility:

.1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.

.2 O&M personnel have been fully trained in aspects of installed systems.

.3 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O&M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.

.2 BMM - Building Management Manual.

.3 EMCS - Energy Monitoring and Control Systems.

.4 MSDS - Material Safety Data Sheets.

.5 PI - Product Information.

.6 PV - Performance Verification.

.7 TAB - Testing, Adjusting and Balancing.

.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: Short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 95% completed before added into Project Specifications.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:

.1 Approved shop drawings and product data. Approved changes to contract.

.2 Contractor's project schedule.

.3 Cx schedule.

.4 Contractor's, sub-contractor's, suppliers' requirements.

.5 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Engineer and obtain written approval.

1.5 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

.1 Changes resulting from Client program modifications.

.2 Approved design and construction changes.

.2 Revise, refine and update every 6 weeks during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Engineer for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Engineer to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.1 Engineer is responsible for:

.1 Organizing Cx.

.2 Monitoring operations Cx activities.

.3 Witnessing, certifying accuracy of reported results.

.4 Witnessing and certifying TAB and other tests.

.5 Ensuring implementation of final Cx Plan.

.6 Performing verification of performance of installed systems and equipment.

.2 Construction Team: Contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:

.1 Testing.

.2 TAB.

.3 Performance of Cx activities.

.4 Delivery of training and Cx documentation.

.5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.

.6 BMM.

.3 Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

1.7 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

.1 Installation contractor/subcontractor:

.1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

.1 To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

.1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:

.1 Modify ventilation rates to meet changes in off-gassing.

.2 Changes to heating or cooling loads beyond scope of EMCS.

.3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.

.4 Redistribution of electrical services.

.5 Modifications to voice communications systems.

.6 Provide names of participants to Engineer and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

.7 Cx Structural and Architectural Systems:

.8 Commission mechanical systems and associated equipment:

.1 Plumbing systems:

.1 Domestic CWS.

.2 Sump pumps.

.2 HVAC and exhaust systems:

.1 HVAC systems

.2 General exhaust systems.

.3 Exhaust systems and related systems.

.4 Heat recovery systems.

.3 Fire and life safety systems:

.1 Fire extinguishers.

.9 Commission electrical systems and equipment:

.1 Low voltage:

.1 Low voltage equipment.

.2 Low voltage distribution systems.

.3 Voice communications systems.

.4 Electronic data and communications information systems.

.2 Lighting systems:

.1 Lighting equipment.

.2 Distribution systems.

.3 Emergency lighting systems, including battery packs.

.4 Fire exit emergency signage.

.3 Alarm systems, equipment:

.1 Annunciators.

.2 Control panels.

.3 Autodialer

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.
.2 Project record documentation.
.3 Inventory of spare parts, special tools and maintenance materials.
.4 Maintenance Management System (MMS) identification system used.
.5 WHMIS information.
.6 MSDS data sheets.
.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

.1 Cx as used in this section includes:
  .1 Cx of components, equipment, systems, subsystems, and integrated systems.
  .2 Factory inspections and performance verification tests. Deliverables: provide:
.2 Cx Specifications.
.3 Start-up, pre-Cx activities and documentation for systems, and equipment.
.4 Completed installation checklists (ICL).
.5 Completed product information (PI) report forms.
.6 Completed performance verification (PV) report forms.
.7 Results of Performance Verification Tests and Inspections.
.8 Description of Cx activities and documentation.
.9 Description of Cx of integrated systems and documentation.
.10 Training Plans.
.11 Cx Reports.
.12 Prescribed activities during warranty period.

.3 Engineer to witness and certify tests and reports of results provided to Engineer.

.4 Engineer to participate.

1.10 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

.1 Pre-Start-Up Inspections: By Engineer prior to permission to start up and rectification of deficiencies to Engineer's satisfaction.

.2 Engineer to use approved check lists.

.3 Engineer will monitor some of these pre-start-up inspections.

.4 Include completed documentation with Cx report.

.5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Engineer and does not form part of Cx specifications.

.6 Engineer will monitor some of these inspections and tests.

.7 Include completed documentation in Cx report.

.2 Pre-Cx Activities - MECHANICAL:

.1 Plumbing systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.2 HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 At this time, complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved by Engineer.

.3 .

.3 Pre-Cx Activities - ELECTRICAL:

.1 Low voltage distribution systems under 750 V:

.1 Requires independent testing agency to perform pre- energization and post-energization tests.

.2 Emergency power generation systems

.1 Transfer switches: test by simulating loss of power. Verify availability of power at equipment requiring same.

.2 Uninterruptible power systems: Test under full and partial load conditions.

.3 Lighting systems

.1 Emergency lighting systems: Tests to include verification of lighting levels and coverage, initially by disrupting normal power.

.4 Lightning protection systems.

1.11 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Engineer’s direction, following equipment, systems:

.3 Engineer to monitor some of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of Engineer.

.4 Performance Verification (PV): Approved Cx Agent to perform.

.1 Repeat when necessary until results are acceptable to Engineer.

.2 Use procedures modified generic procedures to suit project requirements.

.3 Engineer to witness and certify reported results using approved PI and PV forms.

.4 Engineer to approve completed PV reports and provide to Engineer.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Engineer to monitor Cx activities.

.2 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

.3 Engineer to witness, certify reported results of, Cx activities and forward to Owner.

.4 Engineer reserves right to verify a percentage of reported results at no cost to contract.

1.13 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.14 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.15 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 TRAINING PLANS

.1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.17 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of Engineer lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Engineer supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Engineer. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Engineer's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Engineer's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

.1 Contractor will develop and provide to Engineer required project-specific Commissioning forms in electronic format complete with specification data.

.2 Revise items on Commissioning forms to suit project requirements.

.3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on forms.

.2 Confirm operation as per design criteria and intent.

.3 Identify variances between design and operation and reasons for variances.

.4 Verify operation in specified normal and emergency modes and under specified load conditions.

.5 Record analytical and substantiating data.

.6 Verify reported results.

.7 Form to bear signatures of recording technician and reviewed and signed off by Engineer.

.8 Submit immediately after tests are performed.

.9 Reported results in true measured SI unit values.

.10 Provide Engineer with originals of completed forms.

.11 Maintain copy on site during start-up, testing and commissioning period.

.12 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51 - Building Management Manual (BMM).

1.7 LANGUAGE

.1 English.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 TRAINEES

.1 Trainees: Personnel selected for operating and maintaining this facility. Includes building operators, maintenance staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Engineer will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and trained manufacturers' personnel: to provide instruction on the following:

.1 Start-up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operation and Maintenance Manual.

.3 TAB and PV Reports.

.3 Engineer will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:

.1 Transparencies for overhead projectors.

.2 Multimedia presentations.

.3 Manufacturer's training videos.

.4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be three (3) hours in length. A total of 20 hours of training is required.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Engineer will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, and participants.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.

.2 Functional requirements.

.3 System philosophy, limitations of systems and emergency procedures.

.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Inter-Action among systems during integrated operation.

.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.9 VIDEO-BASED TRAINING

.1 Manufacturer's videotapes to be used as training tool with Engineer's review and written approval three (3) months prior to commencement of scheduled training.

.2 On-Site training videos:

.1 Videotape training sessions for use during future training.

.2 To be performed after systems are fully commissioned.

.3 Organize into several short modules to permit incorporation of changes.

.3 Production methods to be professional quality.

.4 Deliverable to be DVD training video.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Division 02

Part 1 General

1.1 REFERENCES

.1 Canadian Environmental Protection Act,1999 (CEPA 1999).

.2 National Fire Code of Canada, [2005].

.3 Transportation of Dangerous Goods Act (TDG Act), [1999] c. 34.

.4 Transportation of Dangerous Goods Regulations (TDG Regulations), T-19.01-SOR/2003-400..

.5 Ozone-Depleting Substances Regulations, SOR/99-07.

.5 Ozone-Depleting Substances Regulations, SOR/99-07.

1.2 DEFINITIONS

.1 Toxic: Substance is considered toxic if it is listed on Toxic Substances List found in Schedule 1 of CEPA.

.2 List of Toxic Substances: Found in Schedule 1 of CEPA, lists substances that have been assessed as toxic. Federal Government can make regulations with respect to a substance specified on List of Toxic Substances. Column II of this list identifies type of regulation applicable to each substance.

.3 PCBs: Includes chlorobiphenyls referred to in Column I of item 1 of the List of Toxic Substances in Schedule I of Canadian Environmental Protection Act.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit photocopy of shipping documents to Engineer when shipping toxic wastes off site.

.2 Maintain one (1) copy of product data in readily accessible file on site.

.2 Submission Requirements:

.1 Submit product data to Engineer in accordance with Section 01 33 00 - Submittal Procedures.

1.4 STORAGE AND HANDLING

.1 Store and handle toxic wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.2 Store and handle flammable and combustible wastes in accordance with current National Fire Code of Canada requirements.

.3 Co-ordinate storage of toxic wastes with Engineer and follow internal requirements for labelling and storage of wastes.

.4 Observe smoking regulations, smoking is prohibited in area where toxic wastes are stored, used, or handled.

.5 Report spills or accidents involving toxic wastes immediately to Engineer and to appropriate regulatory authorities. Take reasonable measures to contain the release while ensuring health and safety is protected.

.6 Transport toxic wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.7 Use only authorized/licensed carrier to transport toxic waste.

.8 Co-ordinate transportation and disposal of toxic wastes with Engineer.

.9 Notify appropriate regulatory authorities and obtain required permits and approvals prior to exporting toxic waste.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of toxic wastes generated on site in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Ensure toxic waste is shipped to authorized/licensed treatment or disposal facility and that liability insurance requirements are met.

.3 Minimize generation of toxic waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.4 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.
.2 Hazardous waste burned for energy recovery.
.3 Lead-acid battery recycling.
.4 Hazardous wastes with economically recoverable precious metals.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Export and Import of Hazardous Waste Regulations SOR/2002-300.

.2 National Fire Code of Canada [2005].

.3 Transportation of Dangerous Goods Act (TDG Act) [1999], (c. 34).

.4 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.2 DEFINITIONS

.1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

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

.3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.4 Workplace Hazardous Materials Information System (WHMIS): A Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and territorial laws.

1.3 SUBMITTALS

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

.2 Submit to Engineer current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Engineer that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.4 STORAGE AND HANDLING

.1 Co-ordinate storage of hazardous materials with Engineer and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and territorial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Engineer.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.

.7 Do not use flammable liquids having flash point below 38 degrees C, such as naptha or gasoline as solvents or cleaning agents.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements. Report spills or accidents immediately to Engineer. Submit a written spill report to Engineer within 24 hours of incident.

1.5 TRANSPORTATION

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable territorial regulations.

.2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.

.3 If hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with Engineer.

.2 Ensure compliance with applicable federal, territorial and municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by territorial authorities to accept subject material.

.4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.

.5 Label container(s) with legible, visible safety marks as prescribed by federal and territorial regulations.

.6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide photocopy of shipping documents and waste manifests to Engineer.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Engineer.

.9 Report discharge, emission, or escape of hazardous materials immediately to Engineer and appropriate territorial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

.1 Only bring on site quantity of hazardous materials required to perform work.

.2 Maintain MSDSs in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

.1 Dispose of hazardous waste materials in accordance with applicable federal and territorial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable territorial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Division 03

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1-[00], Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A23.2-[00], Methods of Test for Concrete.

.3 CAN/CSA-A3000-[98]-A5-[98], Portland Cement.

.4 CAN/CSA-G30.5-[M1983(R1998)], Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CAN/CSA-G30.18-[M92(R1998)], Billet-Steel Bars for Concrete Reinforcement.

1.2 SUBMITTALS

.1 Shop Drawings

.1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.

.2 Drawings to bear stamp and signature of qualified professional engineer registered or licensed in Nunavut, Canada.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: To CAN/CSA-A3000-A5, Type 10.

.2 Reinforcing bars: To CAN/CSA-G30.18, Grade 400.

.3 Other concrete materials: to CAN/CSA-A23.1.

2.2 MIXES

.1 Proportion concrete in accordance with CAN/CSA-A23.1.

.2 Minimum compressive strength at 28 MPa as specified by Engineer.

.3 Nominal maximum size of coarse aggregate: to CAN/CSA-A23.1.

.4 Slump: to CAN/CSA-A23.1.

.5 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1, Table 10.

.6 Admixtures: to CAN/CSA-A23.1.

Part 3 Execution

3.1 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.

3.2 FINISHES

.1 Formed surfaces exposed to view: sack rubbed finish in accordance with CAN/CSA-A23.1.

.2 Equipment pads: provide smooth trowelled surface.

3.3 CURING

.1 Cure and protect concrete in accordance with CAN/CSA-A23.1.

.1 Do not use curing compounds where bond is required by subsequent topping or coating.

3.4 SEALING

.1 Following curing, apply two even coats of linseed oil mixture to clean dry surfaces, each at 8 m^2/L. Allow first coat to dry before applying second coat.

3.5 SITE TOLERANCES

.1 Concrete floor slab finishing tolerance in accordance with CAN/CSA-A23.1.

3.6 FIELD QUALITY CONTROL

.1 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by Engineer.

END OF SECTION

Division 05

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 03 30 05 - Cast-in-Place Concrete.

.3 Section 09 91 23 - Interior Painting.

.4 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

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

.1 ASTM A53/A53M-[02], Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.

.2 ASTM A269-[02], Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-[02], Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

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

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

.3 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel.

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

.3 CAN/CSA-S16.1-[01], Limit States Design of Steel Structures.

.4 CSA W48-[01], Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-[1989(R2001)],Welded Steel Construction (Metal Arc Welding) (Imperial Version).

.4 The Environmental Choice Program

.1 CCD-047a-[98], Paints, Surface Coatings.

.2 CCD-048-[98], Surface Coatings - Recycled Water-borne.

1.3 SUBMITTALS

.1 Product Data:

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

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

.1 For finishes, coatings, primers and paints.

.2 Shop Drawings

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

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

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

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

.3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Storage and Protection:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: To CAN/CSA-G40.20/G40.21, Grade 300W.

.2 Steel pipe: To ASTM A53/A53M standard weight, black finish.

.3 Welding materials: To CSA W59.

.4 Welding electrodes: To CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

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

2.2 FABRICATION

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

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

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

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

2.3 FINISHES

.1 Galvanizing: Hot dipped galvanizing with zinc coating 600 g/m^2 to CAN/CSA-G164.

.2 Chromium plating: Chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.

.3 Shop coat primer: To CAN/CGSB-1.40.

.4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

2.5 SHOP PAINTING

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

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

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

2.6 PIPE RAILINGS

.1 Steel pipe: 40 mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Galvanize pipe railings after fabrication.

Part 3 Execution

3.1 ERECTION

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

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

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

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

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

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

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

.8 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 CLEANING

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

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

END OF SECTION

Division 06

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA B111-1974 (R1998), Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-[M1978(R1998)], Douglas Fir Plywood.
- .4 CAN/CSA-O141-91 (R1999), Softwood Lumber.
- .5 CSA O151-M1978 (R1998), Canadian Softwood Plywood.
- .6 CAN/CSA-O325.0-92 (R1998), Construction Sheathing.

.2 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber [2000].

1.2 QUALITY ASSURANCE

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

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

.3 Plywood, OSB and wood based composite panel construction sheathing identification: By grademark in accordance with applicable CSA standards.

Part 2 Products

2.1 LUMBER MATERIAL

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

- .1 CAN/CSA-O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

- .1 S2S is acceptable
- .2 Board sizes: "Standard" or better grade.
- .3 Dimension sizes: "Standard" light framing or better grade.
- .4 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

.1 Douglas Fir Plywood (DFP): To CSA O121, standard construction.

.2 Canadian Softwood Plywood (CSP): To CSA O151, standard construction.

.3 Plywood, OSB and wood based composite panels: To CAN/CSA-O325.

2.3 ACCESSORIES

.1 Nails, spikes and staples: To CSA B111.

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

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

2.4 FINISHES

.1 Galvanizing: To CAN/CSA-G164, use galvanized fasteners.

2.5 WOOD PRESERVATIVE

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

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

.3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used.

Part 3 Execution

3.1 PREPARATION

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

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

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

.4 Treat material as follows:

.1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

.2 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.2 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support casework, cabinets, and other work as required.

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

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

.5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using fasteners.

.6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.7 Install sleepers as indicated.

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

3.3 ERECTION

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

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

3.4 SCHEDULES

.1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Standing and running trim.

.2 Interior and exterior frames.

.3 Shelving.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A208.1-99, Particleboard.
.2 ANSI A208.2-94, Medium Density Fibreboard (MDF).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM E1333-96, Test Method for Determining Formaldehyde Concentrations in Air and Emissions Rates from Wood Products Using a Large Chamber.

.3 Architectural Woodwork Manufacturers Association of Canada (AWMAC)

.1 AWMAC Quality Standards for Architectural Woodwork [1994].

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-11.3-M87, Hardboard.

.5 Canadian Standards Association (CSA)

.1 CAN/CSA-A247-M86(R1996), Insulating Fibreboard.
.2 CSA B111-74(R1998), Wire Nails, Spikes and Staples.
.3 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
.4 CSA O115-M82(R2001), Hardwood and Decorative Plywood.
.5 CSA O121-M78(R1998), Douglas Fir Plywood.
.6 CAN/CSA O141-91(R1999), Softwood Lumber.
.7 CSA O151-M78 (R1998), Canadian Softwood Plywood.

.6 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber [2000].

1.4 SHOP DRAWINGS

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

.2 Indicate details of construction, profiles, jointing, fastening and other related details.

.3 Indicate materials, thicknesses, finishes and hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Protect materials against dampness during and after delivery.

.3 Store materials in ventilated areas, protected from extreme changes of temperature or humidity.

Part 2 Products

2.1 LUMBER MATERIAL

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

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.3 AWMAC custom grade, moisture content as specified.

2.2 ACCESSORIES

.1 Nails and staples: To CSA B111; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; stainless steel finish elsewhere.

.2 Wood screws: stainless steel type and size to suit application.

.3 Splines: Wood.

.4 Adhesive: Recommended by manufacturer.

.5 Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section.

Part 3 Execution

3.1 INSTALLATION

.1 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

3.2 CONSTRUCTION

.1 Fastening.

.1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.2 Standing and running trim.

.1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.

.2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.

.3 Make joints in baseboard, where necessary using a 45^{o} scarf type joint.

.4 Install door and window trim in single lengths without splicing.

.3 Interior and exterior frames.

.1 Set frames with plumb sides, level heads and sills and secure.

.4 Shelving.

.1 Install shelving on ledgers.

3.3 SCHEDULES

.1 Shelving.

.1 Hardwood plywood:

.1 Thickness: 19.

.2 Number of plies: 5.

.3 Sanding: No sanding.

.2 Edge banding: Provide 10 mm thick solid matching wood strip on plywood exposed in final assembly. Strips same width as plywood.

END OF SECTION

Division 07

Part 1 General

.1 This section applies to the supply and installation of board insulation required in the Intake Building and Power Building Floor.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S604-M91, Standard for Type A Chimneys.

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

.3 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

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

Part 2 Products

2.1 INSULATION

.1 Extruded polystyrene (XPS) to CAN/ULC-S701.

.1 Type: 4.

.2 Thickness: as indicated.

.3 Edges: square.

.4 Standard of acceptance Styrofoam Hi -40 as manufactured by Dow Chemical of Canada.

2.2 ADHESIVE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24.

.1 Type: Emulsion type asphalt insulation adhesive of trowel consistence.

.2 Standard of acceptance – Bakelite 200-02

2.3 ACCESSORIES

.1 Insulation clips: Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

.2 Sealant: To CGSB 19 GP21M.

.3 Tape: As recommended by manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.4 Offset both vertical and horizontal joints in multiple layer applications.

.5 Do not enclose insulation until it has been inspected and approved by Engineer.

3.3 RIGID INSULATION INSTALLATION

.1 Adhesive to manufacturer's recommendations.

3.4 CLEANING

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

END OF SECTION

Part 1 General

.1 This section applies to the trim and flashing required for building penetrations and penetrations into fabricated junction boxes.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 The Aluminium Association Inc. (AA)

.1 The Aluminium Association Inc. (AA)

.1 Aluminium Sheet Metal Work in Building Construction-[2000].

.2 AA DAF45-97, Designation System for Aluminium Finishes.

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

.1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel

.1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel

.2 ASTM A591/A591M-98, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating [Mass] Applications.

.3 ASTM A606-01, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.4 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM A792/A792M-02, Standard Specification for Steel Sheet, 55% Aluminium-Zinc Alloy-Coated by the Hot-Dip Process.

.6 ASTM B32-00, Standard Specification for Solder Metal.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Aluminium-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33 with AZ150 coating.

2.2 PREFINISHED ALUMINUM SHEET

.1 Finish: factory applied coating to CAN/CGSB-93.1 supplemented and amended as follows:

.1 Type 1.

.2 Class F1S

.3 Colour selected by Engineer from manufacturer's standard range.

.4 Outdoor exposure period: 35 years.

2.3 ACCESSORIES

.1 Isolation coating: Alkali resistant bituminous paint.

.2 Sealants: SikaFlex 1A or equivalent.

.3 Washers: Of same material as sheet metal, 1 mm thick with rubber packings.

.4 Touch-up paint: As recommended by pre-finished material manufacturer.

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details

.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AA-Aluminum Sheet Metal Work in Building Construction.

.3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

.1 Form all flashings, copings and fascias to profiles indicated of 1.2 mm thick prefinished aluminum.

Part 3 Execution

3.1 INSTALLATION

.1 Install sheet metal work as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.4 Lock end joints and caulk with sealant..

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 23 and 26, respectively.

1.2 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ULC-S115-1995, Fire Tests of Firestop Systems.

1.3 SAMPLES

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

.2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.4 SHOP DRAWINGS

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

.2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

1.5 PRODUCT DATA

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

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: In accordance with ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended and conforming to special requirements specified in 3.5.

.2 Firestop system rating: 2 hours.

.2 Service penetration assemblies: Certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.

.3 Service penetration firestop components: Certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: Non-sagging.

Part 3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Engineer when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through walls.

.2 Edge of floor slabs at wall.

.3 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.4 Around mechanical and electrical assemblies penetrating fire separations.

.5 Rigid ducts: greater than [129 cm^2]: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

Division 09

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 02 61 33 - Hazardous Materials.

.3 Section 01 45 00 - Quality Control.

.4 Section 01 61 00 - Common Product Requirements.

.5 Section 01 78 00 - Closeout Submittals.

.6 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

.1 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.2 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.3 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.4 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Engineer.

1.4 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.
.2 Manufacturer's product number.
.3 Colour number[s].
.4 MPI Environmentally Friendly classification system rating.
.5 Manufacturer's Material Safety Data Sheets (MSDS).

1.5 SAMPLES

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

.2 Submit full range of available colours where colour availability is restricted.

1.6 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver and store materials in original containers, sealed, with labels intact.

.3 Labels shall clearly indicate:

.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.4 Remove damaged, opened and rejected materials from site.

.5 Provide and maintain dry, temperature controlled, secure storage.

.6 Observe manufacturer's recommendations for storage and handling.

.7 Store materials and supplies away from heat generating devices.

.8 Store materials and equipment in a well ventilated area with temperature range 7^0C to 30^0C.

.9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.11 Remove paint materials from storage only in quantities required for same day use.

.12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.13 Fire Safety Requirements:

.1 Provide one 9 kg Type BC fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.7 SITE REQUIREMENTS

.1 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 5 ^{0}C before paint has thoroughly cured.

.2 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of the Engineer such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the latest edition of the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall be water clean-up.

.4 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.6 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Engineer will provide Colour Schedule.

.2 Colour schedule will be based upon selection of two (2) base colours and one (1) accent colours.

.3 Selection of colours will be from manufacturers full range of colours.

.4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.5 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Engineer's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Engineer.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category/	Units @ 60E/	Units @ 60E/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

2.5 EXTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications:

.1 EXT 5.1A - Quick dry enamel semi gloss finish.

.2 Galvanized Metal: Not chromate passivated

.1 EXT 5.3A - Latex semi gloss finish.

.3 Aluminum: sash, sills and frames, flashing, posts and railings, downpipes, etc.

.1 EXT 5.4A - Alkyd semi gloss finish (over vinyl wash primer and quick dry primer).

Part 3 Execution

3.1 GENERAL

.1 Perform preparation and operations for exterior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Engineer damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Engineer. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Engineer.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Removal of light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.5 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.6 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Engineer.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare exterior surfaces in accordance with MPI Painting Specification Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by brushing, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of

blast products from surfaces, pockets and corners to be painted by brushing with clean brushes or brushing/vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.7 Do not apply paint until prepared surfaces have been accepted by the Engineer.

3.5 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Engineer.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

.5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.9 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

.4 Paint fire protection piping red.

.5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

.1 Field inspection of exterior painting operations to be carried out be independent inspection firm as designated by Engineer.

.2 Advise Engineer when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

.1 Clean and re-install all hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Engineer. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Engineer.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Material and installation of site applied paint finishes to new interior surfaces, including site painting of shop primed surfaces.

.2 Related Sections:

.1 Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.
.2 Section 01 33 00 - Submittal Procedures.
.3 Section 01 35 30 - Health and Safety Requirements.
.4 Section 01 45 00 - Quality Control.
.5 Section 01 61 00 - Common Product Requirements.
.6 Section 01 78 00 - Closeout Submittals.
.7 Section 02 61 33 - Hazardous Waste.

1.2 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - [1995], (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, [2004].

.5 National Fire Code of Canada - [1995]

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.

.2 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.4 SCHEDULING

.1 Schedule painting operations to prevent disruption of occupants.

1.5 SUBMITTALS

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

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces .

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.3 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.4 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

Part 2 Products

MATERIALS

.1 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.2 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water-based

.3 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

2.2 COLOURS

.1 Engineer will provide Colour Schedule after Contract award.

.2 Colour schedule will be based upon selection of five base colours and three accent colours.

.3 Selection of colours from manufacturers full range of colours.

.4 Where specific products are available in restricted range of colours, selection based on limited range.

.5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.2 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.3 Thin paint for spraying in accordance with paint manufacturer's instructions.

.4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces [as indicated] [and] [as noted on Finish Schedule].

2.5 INTERIOR PAINTING SYSTEMS

.1 Structural steel and metal fabrications: columns, beams, joists:

.1 INT 5.1E Alkyd – semi gloss finish.

.2 Aluminum: unanodized:

.1 INT 5.4A - Alkyd semi gloss finish.

.3 Dressed lumber: including doors, door and window frames, casings, mouldings:

.1 INT 6.3B - Alkyd semi gloss finish.

.4 Wood paneling and casework: partitions, panels, shelving, millwork:

.1 INT 6.4A - Latex flat finish (over alkyd sealer).

2.6 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Engineer.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining

coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.4 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.6 Touch up of shop primers with primer as specified.

3.4 APPLICATION

.1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish inside of cupboards and cabinets as specified for outside surfaces.

.10 Finish closets and alcoves as specified for adjoining rooms.

.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.5 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.7 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.6 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.7 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

END OF SECTION

Division 13

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials, fabrication and performance criteria for prefabricated buildings.

.2 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 35 30 - Health and Safety Requirements.
.3 Section 02 61 33 - Hazardous Materials.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)

.2 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 30M-95, Standard for Steel Building Systems.

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

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council (NRC)/Institute for Research in Construction (IRC)

.1 NRCC 38726-1995, National Building Code of Canada (NBC).

1.3 SYSTEM DESCRIPTION

.1 Provide building structure and enclosure to physical dimensions shown on drawings.

1.4 DESIGN REQUIREMENTS

.1 Design building to allow for thermal movement of component materials caused by ambient temperature range of 80 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Ensure total absence of condensation on interior surfaces under following minimum condition.

.1 Interior: 22 degrees C 30% RH, still air.
.2 Exterior: -50 degrees C 50 km/h wind.

.3 Building watertight construction.

.4 Vapour seal building enclosure to withstand, without failure, design RH at design ambient temperature condition, maintained against interior atmospheric pressure of 250 Pa.

.5 Design for hourly velocity pressure of 0.49 kPa for 1/10 probability.

.1 In addition to uniform live load, design for full live load on leeward half of building frame and zero live load on windward half.

.6 Design members to withstand, within acceptable deflection limitations:

.1 Snow load of S_S: 2.9 kPa; S_R: 0.2 kPa.

.2 Earthquake load of S_a: 2; S_v: 1.

.7 Design building enclosure elements to accommodate, by means of expansion joints, movement in wall and structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration or glass breakage.

.8 Design, assemble and secure building elements to building frame to ensure stresses in sealants and seals are within sealant manufacturer's recommended maximum.

.9 Allow for ceiling, piping, conduit and other interior dead loads imposed on this structure.

.10 Building interior environment: Heated to maintain temperature of 20 degrees C.

.11 Access doors to sizes and locations indicated weather resistant, insulated and weather-stripped.

1.5 PERFORMANCE REQUIREMENTS

.1 Maximum deflection for roofing under full specified live load: 1/180 of clear span.

.2 Maintain following tolerances for building structure and enclosure elements.

.1 Maximum variation from plane or location shown on shop drawings: 1 mm/1 m of length and up to 1 mm/5 m maximum.

.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

1.6 SUBMITTALS

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

.2 Product Data:

.1 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 61 33 - Hazardous Materials, for following.

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

.3 Submit shop drawings stamped and signed by signature and qualified professional Engineer registered or licensed in Territory of Nunavut, Canada for fabricator designed assemblies, components and connections.

.4 Indicate plans and grid lines, structural members and connection details, bearing and anchorage details, framed openings, accessories, schedule of materials and finishes, camber and loadings, fasteners and welds.

.5 Indicate detailed description of mechanical, electrical and other systems in Work.

.6 Describe requirements of other systems of components related to this Work but provided by others.

.1 Obtain necessary information required to detail this Work including methods of integration and securing.

.7 Submit erection drawings to Engineer for approval, before construction.

.8 Indicate erection dimensions and methods.

Part 2 Products

2.1 MATERIALS

.1 Metal for panels will be galvanized steel with a minimum thickness of 1.27 mm. Exterior panels will have a factory applied finish, suitable for the climate, color equivalent to "white polyester".

.2 Insulation for panels will be 100% foamed in place urethane, to minimum thickness of 125 mm specified.

.3 Fabricate panels to be composite units with metal panels on each side with a foamed 100% urethane insulation core.

.4 Insulation to be foamed in place and when completely heat-cured, fully bonded to metal panels. Thickness to be minimum 125 for walls, 125 mm doors 125 mm for ceilings.

.5 Panels to have an overall thickness measured out to approximately 125 mm or more for all sections, as detailed on drawings.

.6 Panels are to be fabricated with all required structural steel, stiffeners and reinforcing required for erection, door supports, etc., in sizes and configurations to meet the form shown on the drawings.

.7 Entrance door panels and frames are to suit the size and configuration indicated on the drawings, also to be adequately reinforced to prevent racking or twisting under all reasonable use. Maximum design temperature differential across the door is 70 degrees Celsius.

.8 Panels are to be designed and fabricated to tightly fit together by tongue and groove edge fit and mechanical connection. Mechanical connectors are not to exceed 400 mm.o/c and shall be of such design as to tightly draw together adjacent panels. Include all necessary wall to floor connection hardware suitable for this application.

.9 The building system is to include a complete exterior UV and weatherproof roof package, constructed with wall panels, complete with flashing, sealant, and all necessary related components.

.10 Door hardware: Satin finish aluminum, fit door with:

.1 Two (2) uplift type hinges with 230 mm blades and 10 mm diameter pins.

.2 Tamperproof latch and strike assembly, with interior safety release and fitted for exterior padlock.

.3 Replaceable thermos plastic gaskets having magnetic core for closure and seal.

.4 Bottom edge dual blade, rubber wiper gasket.

.5 Metal rain shield.

.11 Standard of Acceptance: Cold Stream, Balley, Advance Panel.

Part 3 Execution

3.1 ERECTION

.1 Do prefabricated metal building Work to CSSBI 30M.

.2 Erect building structure and enclosure elements.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.3 CLEANING

.1 Remove excess sealant by moderate use of low VOC mineral spirits or other solvent as directed by sealant manufacturer.

.2 Clean surfaces.

3.4 PROTECTION

.1 Provide protection to finished surfaces with strippable coatings, strippable wrappers, plywood or sheet materials as required before acceptance of Work.

END OF SECTION

Division 15

Part 1 General

1.1 SUMMARY

.1 Section describes the basis functioning of the water treatment facility to be included in the Work. It shall be used for evaluating the completeness of the Work and shall be read in conjunction with Division 15, Division 22, Division 26 and with the piping and instrumentation diagrams in the drawings to obtain a description of the plant operations and process.

1.2 RELATED SECTIONS

.1 Division 22 - Plumbing

.2 Division 26 - Electrical

Part 2 Products

2.1 PROCESS NUMBERING

.1 All process equipment including piping and valves has been numbered for clarity. Refer to Drawing 201.

2.2 PROCESS ALARM

.1 Major process alarms are related to equipment malfunctions which if not rectified immediately could lead to damage of process units, severe deterioration in effluent quality or plant flooding. Major alarms shall activate plant alarm and beacon.

2.3 CONTROL

.1 Controls are classified into two categories as follows:

.1 Automatic: Control functions are coordinated by a central plant control panel or at local control panels.

.2 Manual: Operator controls the functioning of the process unit by manipulation from a local control panel.

Part 3 Execution

3.1 TREATED WATER PRODUCTION

.1 Truckfill button is switched to ON and intake pumps activate as existing operation.

.2 Motorized valve (MV) 1 is open; MV 2 is closed.

.3 Flow moves through existing truckfill arm.

.4 Flow through 75 micron mesh basket filter to remove large debris pre-cartridge filtration system.

.5 Normal operation of 3x20 micron filter: IV 9 is closed; IV 1 and 2 are open. Filter by-pass: IV 1 and 2 are closed; IV 9 is open.

.6 Normal operation of 5x5 micron filter: IV 10 is closed; IV 3 and 4 are open. Filter by-pass: IV 3 and 4 are closed; IV 10 is open.

.7 Normal operation of 5x1 micron filter: IV 11 is closed; IV 5 and 6 are open. Filter by-pass: IV 5 and 6 are closed; IV 11 is open.

.8 Normal operation of 5x5 micron filter with activated carbon block (to remove colour, taste and odour in spring): IV 12 is closed; IV 7 and 8 are open. Filter by-pass: IV 7 and 8 are closed; IV 12 is open.

.9 Flow through FI/FT1 activates CMP 1 and chlorinates (using calcium hypochlorite and a metering pump) water to regulated (Health and Social Services, Government of Nunavut) total chlorine and free available chlorine concentrations.

.10 Flow back to pumphouse and through existing truckfill arm to truck.

3.2 FIRE FLOW TRUCKFILL SYSTEM

.1 IV 13 and 16 are closed; IV 14 and 15 are opened.

.2 Fireflow button is switched to ON and intake pumps activate as previously.

.3 MV 1 closes; MV 2 is opens.

.4 Existing chlorine metering pump activates as previously disinfecting water prior to entering truck.

3.3 WASTEWATER SYSTEM

.1 The wastewater system will have the following components:

- .1 Floor and sink drains.
- .2 Sump and automatic sump pump.
- .3 Building sewage storage tank.
- .4 High level alarm.
- .5 Sewage tank pump out.

.2 All drain water gravity flows to sump. When level switch in sump reaches maximum height, sump pump moves water to wastewater tank.

.3 Wastewater tank is manually drained when full. Level sensor (LS) 3 and Level transmitter (LT) 3 trigger an alarm light when wastewater tank is full.

3.4 DOMESTIC WATER SYSTEM

.1 The domestic water system will have the following components:

- .1 Solenoid valve.
- .2 100L water tank.
- .3 Tank level sensor and transmitter.
- .4 Water pump.
- .5 Hose bib and reel.

.2 During truckfill, when a level sensor in the water tanks reaches a minimum depth, SV1 will open and the water tank will be filled until the level switch reaches a maximum depth, causing SV1 to close.

.3 Water hose is feed by water in the 100L tank via the domestic treated water pump (TWP1).

.4 When wastewater tank is full, LS/LT 3 disallows TWP 1 from running.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes the supply, installation and testing of process piping, fittings and piping supports.

1.2 RELATED SECTIONS

.1 Section 15 01 00 - Process Description

.2 Section 15 10 50 - Detailed Piping: Specification Sheets

.3 Section 15 11 00 - Process Valves

.4 Section 15 91 00 - Identification

.5 Section 15 95 00 - Disinfection of Structures and Piping

1.3 STANDARDS

.1 Work covered by these specifications shall be carried out in accordance wit, but not limited to, the following standards which shall be deemed to be and form part of these specifications:

.1 NWT Boiler and Pressure Vessel Regulations
.2 American Society of Mechanical Engineers
.3 American National Standards Institute
.4 American Society for Testing and Materials
  .1 ASTM A53 Specification of Welded and Seamless Steel Pipe
  .2 ASTM A181 Specification for Forged or Roller Steel Pipe Flanges. Forged Fittings and Valves and Parts for General Service
  .3 ASTM D1785 Polyvinyl Chloride Pipe and Fittings and F-441
  .4 A385 Galvanized Bolts and Nuts
.5 American Water Works Association
  .1 AWWA C208 Dimensions for Steel Water Pipe Fittings
  .2 AWWA C210 Coal Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
  .3 AWWA C500 Gate Valves, 3 through 48 in NPS
  .4 AWWA C504 Specifications for Rubber-Seated Butterfly Valves
  .5 AWWA C507 Specifications for Ball Valves
.6 Chlorine Institute Standards
.7 Manufacturer’s Standardization Society

1.4 DELIVERY AND STORAGE

.1 Pipe shall be delivered to site using loading methods that do not damage pipe or casings.

.2 Pipe delivered to site shall be clearly identified as to size, type and coatings.

.3 Until ready for incorporation in the Work, store on site, as recommended by the pipe manufacturer to prevent damage, undue stresses, or weathering.

.4 All gasket surfaces, flange faces and butt welding connections of valves shall be thoroughly cleaned, greased and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

.5 All exposed male threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be cleaned and closed with pipe, plugs or steel or plastic snap in protectors.

.6 When storing plastic piping, provide adequate support to prevent pipe deformation.

1.5 PROCESS PIPING IDENTIFICATION CODES

.1 Process piping shall be identified in drawings by a three component alpha-numeric code.

.1 First part of code identifies the pipe material.

.2 Second part of code identities the nominal pipe diameter.

.3 Third part of code defines the process fluid being conveyed in the pipe.

.2 Process fluid codes are defined in the drawings.

Part 2 Products

2.1 PIPE MATERIALS

.1 Pipe materials shall be new, free from defects and shall conform to reference standards identified in Section 15 10 50 - Detailed Piping: Specification Sheets.

2.2 FLANGES

.1 Flanges on steel pipe shall be 150#, conforming to ANSI B16.5. unless otherwise indicated.

.2 Flanges for mating to equipment or valves shall be compatible with those items.

.3 Flat-faced flanges shall be provided on each side of butterfly valves. Flat-faced flanges shall be used when mated to cast iron flanges.

.4 For steel piping, weld neck flanges shall be provided for both sides of wafer or lug body valves.

.5 For steel piping, where not specified or shown otherwise, slip-on flanges shall be furnished.

.6 Adapters shall be installed in accordance with the manufacturer's recommendations.

.7 Slip-on flanges that are attached to a pipe by means of set screws and gaskets (uni-flange), etc) shall not be used with the prior approval of the Engineer.

.8 Flat face flanges and full face gaskets shall be used on check valves 75 mm to 200 mm.

2.3 THREADED COUPLINGS

.1 Unless specifically noted in the drawings, threaded couplings shall only be used on piping with nominal diameters equal or less than 50 mm.

.2 Screwed joints shall be made using American Standard threads.

.3 Thread lubricant for threaded joints shall be Teflon tape (or pipe dope).

2.4 REDUCERS

.1 Reducers shall be concentric unless otherwise indicated.

2.5 ELBOWS

.1 Elbows shall be short radius unless otherwise indicated.

2.6 GAUGES

.1 Gauges shall be Bourdon tube type with 115 mm (4.5") diameter face, liquid silicone filled, dual (pascal/psi) scale, complete with phenolic turret case with the following specifications:

.1 Accuracy: 0.5%

.2 Pressure range: 0 to 450 kPa

.2 Provide brass needle type isolating valve and snubber for each gauge.

.3 Standard of Acceptance: Ashcroft® Duragauge or equal approval.

2.7 GASKETS

.1 For flat-faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets.

.2 Gasket materials for flanged connections shall be as follows:

.1 Material Thickness:

.1 1.6 mm thick, pipe diameter 80 to 250 mm.

.2 3.2 mm thick, 80 mm and 100 mm PVC

.2 Liquid Service:

.1 Service temperature, less than or equal to 40°C: Black neoprene or red rubber.

.2 PVC: Cloth inserted red rubber or black neoprene.

.3 Grooved joint gaskets shall be as recommended by the manufacturer for the service conditions indicated.

2.8 NUTS AND BOLTS

.1 Nuts and bolts shall be hex head.

.2 For general service, nuts and bolts shall be forged steel to ASTM A193, Grade B7 and ASTM A124, Grade 2H.

.3 For submerged, buried and concrete encased service or when used with stainless steel to ASTM A 193, Grade B8 and ASTM A194, Grade 8.

2.9 PIPE SUPPORT SYSTEM

.1 No attempt has been made to indicate all necessary pipe supports in the drawings for piping inside the plant. The intent has been to indicate general arrangements and typical spacings, but not relieve the contractor of the responsibility of designing and supplying a complete support system.

.2 All pipe shall be supported in accordance with the manufacturer's recommendations.

.3 Pipe support systems shall be designed to support the operating loads with a factor of safety of 5.0.

.4 Make provision for expansion, contraction, longitudinal thrust, slope and anchorage.

.5 Do not support piping from equipment or other pipes.

.6 Where structural bearings are not in suitable locations, provide supplementary structural members. Obtain approval of the Engineer for the location and type of supports.

.7 Provide hangers and/or base supports within one meter of each change in direction on each leg, on one side of each valve, and on the first spool piece or fitting from a piece of equipment.

.8 Maximum support spacing shall be as listed in the following table:

Pipe Size, Nominal (mm)	Maximum Spacing (m)		
	Steel or Iron	PVC (100°f)/HOPE	FRP
30 and under	1.8	1.0	1.5
30 to 40	2.7	1.3	1.8
40 to 50	3.0	1.5	2.1
60 to 75	3.0	1.6	2.4
100	3.6	2.0	2.7
150	3.6	2.2	3.0

.9 Copper piping up to 15 mm in size shall be supported every 1.8 m on centre. Piping larger than 15 mm shall be supported every 2.4 m on centre. Provide a double thickness of Plycoflex 310 on Greenline accessory tape between the copper pipe and the supports.

2.10 PIPE RACKS

.1 Metal framing for pipe racks shall consist of a system of aluminium channel members and bolted connections.

.2 Metal framing materials shall conform to ASTM A570, Grade L and shall be hot dipped, galvanized after fabrication.

.3 All flexible tubing for chemical solution, feed and transfer lines shall be supported or mounted on continual galvanized mild steel trays for all horizontal, inclined or vertical runs.

.4 The lines shall be tied to the trays at intervals of not greater than 3 m for horizontal runs and 2.5 m for all other runs.

.5 Standard of Acceptance: Canstruct – Burndy Electray Ventrib

2.11 PIPE HANGERS

.1 Hangers shall be fabricated in accordance with ANSI B31.1, Part 5 and the requirements of ULC Standard C203.

.2 Do not use perforated band, wire chain, or solid ring type hangers.

.3 Hangers shall be of the following type:

Pipe Size (mm)	Hanger Type
40 and less	Split adjustable ring, Hunt Fig. 269
50 to 100	Clevis, Hunt Fig. 260
Greater than 100	Roller and Clevis, Hunt Fig. 174

.4 Hangers shall be black finish raw steel except as detailed otherwise. Use stainless steel hangers where detailed on the drawings.

.5 Provide spring hangers where required to offset expansion in horizontal runs which follow vertical risers longer than 3.0 metres.

.6 Rod material shall conform to ASTM A307 as a minimum and shall be hot dipped galvanized. Stainless steel hangers shall be used where detailed is already stated.

.7 Hanger rod sizing, as a minimum, shall as follows:

Pipe Size, Nominal (mm)	Hanger Rod Diameter (mm)
50	10

80	12
100	16
150	20
200	22
250	25
300	25

.8 Length adjustment collars shall be provided for hanger rods.

.9 Threaded expansion type inserts shall be used to connect piping supports to concrete.

.10 Aluminium or galvanised steel clips shall be used to support piping from aluminium or steel structural members. Where metals of different type are to be connected, provide isolation to prevent galvanic corrosion.

2.12 PEDESTEL PIPE SUPPORTS

.1 Pedestal pipe supports shall be fitted with manufactured cradles and adjustment bolts as indicated in the drawings.

.2 The pipe used for the pedestal shall conform to ASTM A53, Grade B. The base plate shall be steel to ASTM A36.

2.13 BASE ELBOWS

.1 Where elbows change the run of a horizontal pipe to a vertical direction, supports shall be secured to the elbow.

.2 Dimensions for the supports shall be as follows:

Pipe Size, Nominal (mm)	Support Pipe, Diameter (mm)	Base Plate (mm x mm)
100 or less	50 Schedule 40	100 x 6
150	80 Schedule 40	125 x 6

2.14 PIPE VENTING AND DRAINAGE

.1 The Contractor shall provide adequate air vent valves with blowout lines at high points on all piping under hydraulic pressure.

.2 The Contractor shall provide ball-type drain valves at least 40 mm in diameter at low points on piping under hydraulic pressure.

2.15 PRESSURE SIGNAL TUBING

.1 Tubing for pressure control elements shall be annealed type 304 S.S. to ASTM A269.

.2 Tubing shall have a minimum diameter of 6 mm and minimum wall thickness of 0.71 mm.

.3 Supply all isolation valves, couplings and NPT male end connectors as shown on drawings or as required to make a complete installation.

2.16 WELDING MATERIALS

.1 Welding materials shall conform to CSA W48.1.

.2 Electrodes shall be compatible with the material welded and shall deposit metal with strength and corrosion resistance properties at least equivalent to the base metal.

.3 The Contractor shall submit to the Engineer at least three (3) weeks prior to commencing welding, a written statement of proposed welding techniques and materials for the Engineer's review.

2.17 DISSIMILAR METAL CONNECTIONS

.1 Where dissimilar metals are to be connected, furnish dielectric fittings and/or isolating flanges.

2.18 STRUCTURAL ELEMENTS PENETRATIONS

.1 Where exposed piping penetrates laboratory, storage, control room or other similar finished area, chrome plates, escutcheon plates or equivalent shall be provided.

2.19 FIELD JOINT MATERIAL

.1 Polyurethane sealant shall be butyl rubber vapour barrier "Butyl" manufactured by Chemtron, Calgary or approved equal.

.2 Strapping shall be stainless steel "Band-It" type or approved equal, applied with the manufacturer’s recommended banding tool. Other sheet metal fasteners shall be as used on shop fabrications.

.3 Caulking between enclosures and piping at all banded, screwed, bolted or riveted joints shall be Tremco JS-700 Permagum, or approved equal, to provide a totally water proof assembly.

2.20 EXTERIOR FINISHES

.1 Unless specified otherwise, the exterior of plain steel pipe shall be shop primed as specified in Section 15 91 00 - Identification.

.2 Plastic and stainless steel pipe shall not be shop coated.

.3 Coal Tar Enamel: Where specified, coal tar enamel and kraft paper shall be applied to the exterior of piping in accordance with AWWA C203.

2.21 GALVANIZING

.1 Where piping is to be galvanized, it shall be hot dip zinc coated to CSA G164 with a minimum coating of 500 g/m^2.

2.22 GROUT

.1 Non-shrink grout shall be used.

Part 3 Execution

3.1 PREPARATION

.1 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.

.2 Piping arrangements indicated on the drawings have been established on the basis of the dimensions from the first listed equipment in the list of approved manufacturers and approved products contained in the specific process equipment sections. At no expense to the Owner, modify the piping arrangement as necessary to suit the equipment supplied under this contract.

.3 Advise the Engineer of all modifications. Do not commence work on the related piping until the Engineer's approval has been received.

.4 Include any piping modifications in the shop drawings submitted prior to fabrication or installation.

3.2 PIPE HANDLING

.1 Each pipe and fitting shall be inspected prior to installation. Damaged pipe or pipe with damaged protective coatings shall not be installed.

.2 Remove all foreign matter from inside of pipe prior to installation.

.3 Repair pipe with damaged protective coatings with material similar to the original, as recommended by the applicable standard.

.4 Use proper implements, tools and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.

.5 Do not drop or roll pipe. Move pipe and fittings, using canvas, leather or rubber padded belt slings. Do not move pipe using bar cables, chains, hooks or clamps.

.6 Remove and replace any material which is damaged or defective.

3.3 CONFLICTS

.1 Review the drawings prior to installation of piping, conduit and fixtures by this or any other division. Identify any conflicts and cooperate with the Engineer to determine the amendments necessary to resolve the conflict.

.2 Confirm the routing of each section of pipework with the Engineer prior to commencement of installation. Advise the Engineer of any conflicts with existing services or services yet

to be installed. Where necessary, amend the routing of pipework to avoid conflict, as directed by the Engineer.

3.4 INTERIOR INSTALLATION

.1 Make adequate provision in piping runs for expansion, contraction, slope and anchorage.

.2 Install pipe support system to adequately secure the pipe and to prevent undue vibration, sag and stress.

.3 Provide temporary support as necessary during construction to prevent overdressing of equipment, valves or pipe.

.4 Accurately cut all piping for fabrication to filed measurements.

.5 Pipe shall be installed in straight alignment. Variance from the true alignment shall not exceed 10 mm in any direction. Pipe runs shall be fabricated and assembled to ensure that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment shall not be permitted. The Contractor shall undo and subsequently remake all pipework connections as directed by the Engineer to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.

.6 Do not cut or weaken the building structure to facilitate installation.

3.5 WELDING

.1 Use manual shielded metallic arc, submerged arc, or inert gas shield arc welding.

.2 Welding procedures shall conform to ANSI B31.3 or B31.1.

.3 Plain pipe ends shall be bevelled prior to welding.

.4 Clean and dry welding surfaces thoroughly prior to welding.

.5 Maintain flanges, pipes and fittings in alignment during welding. Ensure that no part of the weld is offset by more than 20 percent of the pipe wall thickness.

.6 Tack welds shall be made of material equal to the root pass. Tack welds which have not cracked may be incorporated in the root grass.

.7 Ensure the first bead obtains full root penetration with a minimum of weld material projecting within the pipe.

.8 For butt welds of pipe diameters less than 200 mm, welding shall be done in a minimum of two passes.

.9 For lap joints, weld joint in two passes minimum.

.10 Between passes, visually inspect bead of pinholes or other defects. Repair any defects prior to the placement of the next pass.

.11 Clean all flux, slag and other foreign material from the weld prior to applying a successive bead, and on completion of the weld.

.12 Do not start successive passes at the same point.

.13 Completed welds shall completely fill the joint. It shall have reinforcement greater than 1.5 mm and less than 3.0 mm, with no undercutting at the weld edges.

.14 Welding shall not proceed when the metal temperatures fall below -18°C. With metal temperatures below 0°C, supplemental heat will be applied to heat the metal to 20°C.

3.6 THREADED JOINTS

.1 Ream the end of all pipes to remove all burrs and cuttings when fabricating threaded joints.

.2 Clean out pipe prior to joining.

.3 Apply Teflon tape and/or pipe dope to male threads and join pipe. Do not use extra tape to make up for slack in the joint. A minimum of two full threads shall be exposed after the joint is tightened.

.4 Pipelines shall be installed with a few joints as possible. Short length of pipe coupled together shall not used.

.5 If it is necessary to back off a screwed joint after it is made, the thread shall be cleaned and new compound applied.

.6 Threads shall not be caulked.

.7 Bushings shall not be used.

.8 Nipples in screwed piping shall be shoulder nipples. Close nipples shall not be used unless specifically indicated.

3.7 FLANGED JOINTS

.1 Flanges and gaskets shall be cleaned prior to connection.

.2 Gaskets shall be lubricated with soapy water and anti-seize compound shall be applied to the bolts.

.3 Bring flanges into close parallel and lateral alignment.

.4 Bolts shall be tightened progressively. Bolt tightening shall proceed from side to side of the flange. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of Nut and bolt heads.

.5 Washers may not be used to take up excess bolt length.

.6 Bolts projection beyond Nuts shall be approximately two full threads and no more than five threads.

.7 When joining steel to cast iron flanges, take care to avoid damage to the cast iron flange. Ensure both flanges are flat-faced and use full-face gaskets.

.8 Align flanges which connect piping to mechanical equipment to close parallel and lateral alignment prior to tightening bolts. Do not place undue strain on the equipment.

3.8 VENTS AND DRAINS

.1 Install air vents at all high points.

.2 Install drains at all low points and above all valves in vertical legs in liquid lines.

.3 Vents and drains shall be installed using saddles, weldolets, threadolets any other approved fitting. Systems which minimize damage to pipe coating system shall be the preferred method.

.4 Pipe all vents and drains to waste line.

3.9 TESTING

.1 Give Engineer one (1) week notice prior to testing.

.2 Do not insulate or conceal work until piping systems are tested and accepted.

.3 Supply all water required for pressure testing.

.4 Supply all pumps, compressors, gauges, etc., required for testing.

.5 Where necessary, install air threadolets, air relief valves and line fittings valves as necessary to complete testing. Remove after testing and plug the threadolets.

.6 Cap or plug all lines which are normally open ended. Remove on completion of testing.

.7 Isolate all low pressure equipment during testing so as not to place any excess pressure on the operating equipment.

.8 Where defective material or equipment is identified, repair or replace using new material.

.9 Flush and drain liquid pipes after pressure tests.

3.10 PRESSURE TESTING OF LIQUID LINES

.1 All lines normally used for conveyance of liquid shall be pressure tested.

.2 Test pressures and times shall be as follows:

System	Test Pressure (kPa)	Duration of Test (hours)
Raw Water Supply Piping (not including intakes)	1000	4
Pump Suction Supply Piping	525	4
Chemical Solution Lines	700	4
Plant Service Water Piping	1000	4
Pressure which Discharge to Open Tanks	700	4

.3 The test duration and pressure drop shall conform to the requirements of AWWA C600, but the duration of each test shall not be less than those indicated in 3.11.2.

.4 There shall be no visual evidence of leakage.

.5 Instruments having a maximum pressure rating less than the test pressure for the line upon which they are installed, shall be removed or isolated during the pressure test.

.6 Upon successful completion of the system pressure test, removed or isolated instruments shall be replaced and tested with a pressure within the instrument range.

.7 Safety relief valves shall be supplied with test gauges for hydrostatic testing purposes. Upon completion of testing, the gauges shall be removed and the system shall be re-pressured to the relieving pressure of the relief valves to ensure proper valve operation.

.8 All pressure testing shall be done in the presence of the Engineer.

.9 Prior to hydrostatic or pressure testing or disinfection, all water retaining structures, pipework and conducts shall be thoroughly cleaned.

3.11 DISINFECTION

.1 Pipe lines intended for potable water service shall be disinfected after testing in as specified in Section 15 95 00 - Disinfection of Structures and Piping.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes the requirements and specifications for each type of pipe included in Work. The piping materials are listed on the piping and instrumentation drawings.

1.2 RELATED SECTIONS

.1 Section 15 10 00 - Process Piping

.2 Section 15 11 00 - Process Valves

Part 2 Products

2.1 PIPE SPECIFICATIONS

.1 Pipe specification sheets are provided on the following pages.

Pipe Specification No. ST 40		**Reference Document**
Pipe Material:	Carbon Steel - Standard Duty Seamless or ERW 125 mm and less: Schedule 40 150 mm and greater: standard weight to AWWA C200	 ASTM A53B
Pipe to Equipment Connections:	50 mm and less: ANC threads 65 mm and greater: 125# FF flanges or 150# RF flanges	ANSI B2.1 ANSI B16.1 ANSI B16.5
Pipe Joints:	50mm and less: Threaded Above 50 mm: Welded or 150# Flanged Joint	ANSI B16.3 ANSI B16.5
Service Conditions:	Process Fluids: TW Pressure Range: 0 - 1000 kPa Temperature Range: 40°C Size Range: 30 mm to 300 mm	
Flanges:	Weld-Neck Flanges Class 150 Victaulic flanges Class 150 Style 741 (used only where specifically indicated)	ANSI B16.5
Fittings:	50 mm and less: Tthreaded connection 150 lb. Malleable iron. Above 500 mm: carbon steel, standard weight, seamless butt weld. Where shown use standard weight victaulic full flow, grooved end style 77	ANSI B16.3 ASTM A234 Grade WPB
Unions:	Up to 50 mm (threaded piping only) Class 150 malleable iron, ground-joint bronze to iron ends as required.	
Standard Treatment:	Above 50 mm: galvanized (ST 40G) 50 mm and less :galvanized (ST40G)	 ASTM A53

Notes:

1. Design is based on grooved fittings used other type will require addition of unions.

Pipe Specification No. PVC 40		**Reference Document**
Pipe Material:	PVC, Schedule 40	CSA B137.3
Fittings	Same as Pipe or Solvent Weld Type	ASTM D2466 D2467 CSA B137.3
Flanges:	80 mm and greater: PVC Type 1, Grade 1, Class 150 solvent weld type	ASNI B16.1
Pipe to Equipment Connections:	150# flanges	
Pipe Joints:	Solvent Weld Class 150	ANSI B16.1
Unions:	65 mm and smaller - Schedule 80 PVC socket ends	
Solvent Cement:	Approved for use in potable water service	ASTM D2564
Service Conditions:	RW, TW Pressure Range: 0 - 1000 kPa Temperature Range: 0°C - 40°C	

Notes:

1. Schedule 40 pipe shall not be threaded. Where a threaded connection is required, a Schedule 80 socket by thread adapter coupling shall be used.
2. Reducing bushing shall not be used. Where a pipe size change is indicated, it shall be accomplished by the use of reducer couplings, concentric or eccentric as indicated, and manufactured with at least the same working and burst pressure capability as the pipe.

Pipe Specification No. CL Reference		**Reference Document**
Pipe Material:	Copper Piping. Type L	ASTM B88
Fittings:	Compression fittings - copper	
Pipe to Equipment Connections:	Compression fittings	
Pipe Joints:	Soldered - 95/5 tin/antimony	
Unions:	200 lb - bronze, ground-joint. Crane 521 ½ to be used on one side of a valve.	
Adapters:	Bronze adapters provided where screwed valves specified.	
Service Conditions:	TW Pressure Range: 0 – 1050 kPa Temperature Range: 60◦C	

Pipe Specification No. VFT		**Reference Document**
Pipe Material:	Vinyl Flexible Tubing - (clear) Typon Type R3603 as supplied by Fabco Min. Wall thickness: ID 6.5 mm or less – 1.6 mm ID 11 mm to 16 mm – 2.3 mm ID 16 mm to 25 mm – 3.1 mm	
Fittings:	Fabco "Fast and Tite" thermoplastic	
Service Conditions:	Pressure Range: 0- 700 kPa CL piping Temperature Range: 10°C to 30°C	

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes the supply, installation and testing requirements of process valves and actuators.

1.2 RELATED SECTIONS

.1 Section 15 01 00 - Process Description.

.2 Section 15 10 00 - Process Piping.

.3 Section 15 10 50 - Detail Piping: Specification Sheets.

.4 Division 26 - Electrical.

1.3 DELIVERY AND STORAGE

.1 Deliver valves to site using unloading methods which do not cause damage to castings or coatings.

.2 Valves shall be clearly tagged, stating size, type, model number, coatings and mating parts.

.3 Store on site until ready for incorporation in Work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

1.4 PROCESS VALVE SCHEDULES

.1 Process valves are identified in drawings by an alpha-numeric code.

.2 Valve schedule located in this section identifies valve tag number, function, type, size, connections, actuator type and standard of acceptance.

1.5 DEFINITIONS

.1 The following terms shall be used in this specification and are defined for that purpose as follows:

.1	Low Pressure Service:	Less than 500 kPa
.2	Medium Pressure Service:	500 kPa to 1500 kPa
.3	High Pressure Service:	Greater than 1500 kPa

Part 2 Products

2.1 GENERAL

.1 Provide new, unused valves for Work.

.2 Valve materials shall be free from defects or flaws, with true alignment and bores.

.3 Valve bodies shall be clearly marked in raised lettering to indicate the valve type, rating and where applicable, the direction of flow.

.4 Valves shall open counter clockwise.

.5 Valves that are 50 mm and larger, isolation valves are to be butterfly valves. Less than 50 mm are to be ball valves.

.6 All valves shall be supplied by common manufacturer.

.7 Process valve schedule is shown in Drawing 201.

2.2 DRAWINGS

.1 Drawing 201 indicate all valves that are critical to proper process operation.

.2 Detail process drawings and service piping schematic indicate additional valves for the purpose of draining, flushing, pressure reduction and shut off.

2.3 VALVE ENDS

.1 Valves in pipe runs with diameter of 50 mm or less shall be provided with female threaded ends unless indicated otherwise. Threads shall be American National Standard.

.2 Valves in pipe runs with diameter greater than 50 mm shall be flanged unless indicated otherwise.

.3 Lug style wafer body valves shall be tapped holes, suitable for the bolts and nuts used to connect pipe flanges on either side.

.4 Wafer body valves shall have positioning holes, suitable for the bolt spacing of the pipe flanges placed on either side.

.5 Grooved joint valve ends shall only be used where indicated or if the Engineer's prior approval is obtained.

2.4 MANUAL ACTUATORS

.1 Valves shall be provided with manual actuators unless specifically indicated otherwise on the process drawings.

.2 50 mm operating Nuts shall be to AWWA standards. Two operating wrenches shall be provided for each plant area in which operating Nuts are used.

.3 Deep service valves shall be supplied with stem extensions and valve boxes. Two operating tees shall be provided for the plant.

.4 Quarter turn lever operators shall be perpendicular to the pipe run when the valve is closed.

.5 The maximum pull at the end of the lever arm shall not exceed 300 N when one side of the valve is at test pressure and one side is at atmospheric pressure. Where greater than this force would be required to operate the valve with a lever, a gear operated valve operator will be provided.

.6 Gear operators shall be worm gear type, equipped with a hand wheel and a visual indicator of the valve position. They shall be grease lubricated. Where gear operators are intended for direct bury, they shall be sealed units with long life lubricant.

2.5 VALVE STEM EXTENSIONS

.1 Valve stem extensions shall be provided where additional clearance is required for pipe insulation or where valve operation without the extension is difficult, as determined by the Engineer.

2.6 VALVE FLOOR STANDS

.1 Floor stands shall be provided where the operating valve is installed below floor level.

.2 Valve stands shall be capable of withstanding all dead loads and operating loads imposed by electric actuator or a manual hand wheel, as specified in Contract Documents herein.

2.7 FINISHES

.1 Requirements for special interior valve finishes are identified in valve schedules.

2.8 VALVE ACTUATOR

.1 Valve actuators shall be suitable for use on a nominal 120 V, 1 phase, 60 Hz power supply and are to incorporate motor, local "Remote-Stop-Local" and "Open Control -Close" selector switches and terminals for remote control and indication connections.

.2 Rugged compact double sealed watertight enclosure to IP67.

.3 Shall be designed for use in ambient temperatures from -30°C to 70°C.

.4 Positive travel limitation by externally adjustable mechanical stops.

.5 Simple action auxiliary limit switch setting.

.6 Declutchable hand wheel with pad lockable hand/auto selector arranged for power preference.

.7 Self locking electrical and manual drive.

.8 The gear case and all housings are diecast aluminium to BS1490. The main gear case and motor housings are to grade LM4 with remainder being LM24.

.9 Two NC torque-limit and one auxiliary limit switches rated 15A 120/240VAC and 3A 24V DC.

.10 A single phase squirrel cage capacitor run, Class F insulated induction motor with over temperature protection.

.11 Control interface module suitable for local and remote control as selected by the local/stop/remote selector maintained switch. In "Remote' mode, the control circuit shall be fed from an external supply of 120VAC for closing or opening the actuators by suitable remote connections to the actuator terminals.

.12 Standard of Acceptance: As recommended by valve manufacturer.

2.9 GATE VALVES

.1 NPS2 and under, soldered:

.1 Rising stem: To MSSSP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.2 NPS2 and under, screwed:

.1 Rising stem: To MSSSP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

.3 NPS2-1/2 and over, flanged:

.1 Non-rising stem: To MSSSP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.10 GLOBE VALVES

.1 NPS2 and under, Soldered:

.1 To MSSSP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: As indicated.

.2 NPS2 and under, Screwed:

.1 To MSSSP-80, Class 150, 1 MPa, bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: As indicated.

2.11 SWING CHECK VALVES

.1 NPS2 and under, soldered:

.1 To MSSSP-80, Class 125, 860 kPa, bronze swing disc, screw-in cap, regrind seat.

.2 NPS2 and under, screwed:

.1 To MSSSP-80, Class 125, 860 kPa, bronze swing disc, screw-in cap, regrind seat.

.3 NPS2-1/2 and over, flanged:

.1 To MSSSP-71, Class 125, 860 kPa, cast iron body, flat flange faces, bronze disc, regrind seat, bolted cap.

2.12 BALL VALVES

.1 NPS2 and under, soldered:

.1 To ANSIB16.18, Class 150.

.2 Bronze body, chrome plated brass stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon BunaN seat, steel level handle, with NPT to copper adapters.

.2 NPS2 and under, screwed:

.1 Class 150.

.2 Bronze body, chrome plated brass stainless steel ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon BunaN seat, steel level handle.

Part 3 Execution

3.1 PREPARATION

.1 The valve and piping arrangement as indicated in drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in piping to allow for discrepancies between the valve dimensions shown and valves supplied for the Work.

.2 Prior to the installation of the valves, field measure and check all equipment locations, pipe alignments, and structural installations. Ensure that the valve location and orientation provides suitable access to actuators.

3.2 VALVE INSTALLATION

.1 Install valves in conjunction with the piping described in Section 15 10 00 - Process Piping.

.2 In horizontal pipe runs other than in locations where space does not permit, all valves except for butterfly valves shall be mounted with a vertical operating shaft with the actuator at the top. The valve handle is to be perpendicular to the direction of flow when the valve is in the open position.

.3 When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.

.4 Support valves in position using temporary supports until valves are fixed in place.

.5 Where valves are installed in PVC pipework greater than 150 mm diameter, the valves shall be supported independently and braced against operating loads and torque to prevent transmission of stresses to the adjacent pipework.

3.3 VALVE EXTENSIONS

.1 Install valve stem extensions where necessary to provide clearance from insulation.

3.4 VALVE TESTING

.1 Valves shall be operated under simulated and/or real process conditions to ensure they operate as intended.

.2 Valves shall be pressure tested in conjunction with the pipes in which the valves are installed as specified in Section 15 10 00 - Process Piping.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes the chemical feed system for the dosing of chemical hypochlorite. The system shall include all miscellaneous items required for complete and functional operation.

1.2 RELATED SECTIONS

.1 Section 15 10 00 - Process Piping.

.2 Section 15 11 00 - Process Valves.

.3 Division 26 – Electrical.

Part 2 Products

2.1 CHEMICAL METERING PUMPS

.1 Pumps shall be suitable for metering the relevant chemical solution. Pumps shall be of the solenoid-driven diaphragm type with manual adjustable stroke length and manual adjustable stroke frequency.

.2 Pump motors shall be TEFC 120 V, 1 phase, 60 Hz, suitable for continuous operation. A 2 m long power cord shall be provided with each metering pump.

.3 Each pump shall be provided with a backpressure valve, pressure relief valve and suction strainer/foot valve.

.4 Pumps to be supplied mounted on a single FRP support stand or wall mounted pre-plumbed and valved to allow common and dual suction and discharge line configuration.

.5 Chemical Metering Pump 1, CMP1, shall have the following specifications:

.1 Rated Capacity: Up to 20 L/hr at 3 bar (43.5 psi)

.2 Suction Piping: Flexible clear PVC (to allow feeding directly from hypochlorite tank)

.3 Discharge Piping: 6 mm clear PVC

.4 Standard of Acceptance: Grundfos® Alldos Digital Dosing™ Metering Pump with mounting bracket and spare parts kit.

.6 Supply the following additional spare parts, kits and components:

.1 Grundfos® Alldos Installation Set - 553-1017

.2 Grundfos® Alldos Spare Parts Kit - 553-1419

.3 Spare chlorine pump and suction/pressure tubes.

.4 Chemical solution tank.

.5 1% calcium hypochlorite solution.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment in accordance with manufacturer's specifications and recommendations and as shown on the drawings.

3.2 PIPING

.1 Make necessary piping connections to the point of dosing as directed on the drawings.

3.3 TESTING

.1 Ensure equipment including all component parts, operates as designed.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes the requirements for the laboratory equipment to be included in Work.

Part 2 Products

2.1 GENERAL

.1 Supply the spare parts and equipment listed herein.

.2 All spare parts are to be identical make and model as the components supplied in other parts of this project.

2.2 LABORATORY EQUIPMENT

.1 Supply all laboratory and safety equipment as listed in the following table.

Item	Quantity	Equipment Description	Catalog No.
1	1	Hach DR890 portable colorimeter complete with Procedures Manual	48470-00
2	1	Hach DR890 hard-sided case	49425-00
3	1	Hach 2100P portable turbidity meter complete with Instrument and Procedure Manual	46500-00
4	1	2100P Battery Eliminator 120V North American plug	46079-00
5	6	Silicon Oil, 15 mL SCDB	1269-36
6	6	Sample cell oiling cloth	47076-00
7	2	Sample cells, 6-pack, 1 in. round glass, 10 mL with cap	24347-06
8	2	Sample cells, 6-pack, 1 in. round glass, 10 mL with cap	24276-06
9	2	Sample cells, 6-pack, 1 in. round glass, 10 mL and 20 mL with cap	24019-06
10	2	Rack holder, 6 sample cells	-
11	1	Beakers, polypropylene, 100 mL, 12-pack	1080-72
12	1	Beakers, polypropylene, 250 mL, 6-pack	1080-76
13	1	Beakers, polypropylene, 1000 mL, 3-pack	1080-83
14	2	Graduated cylinder, polypropylene, 100 mL	1081-42
15	2	Graduated cylinder, polypropylene, 500 mL	1081-49
16	2	Graduated cylinder, polypropylene, 1000 mL	1081-53
17	2	Wash bottle, polypropylene, 500 mL	620-11
18	2	Thermometer with nylon case, -5 to 45°C	26763-00
19	20	Sample bottles, Dynalon HDPE	D00022
20	5	Hach Total chlorine Reagents (100)	21055-69
21	15	Hach Free Chlorine Reagents (100)	21056-69

22	1	Hach Color Standard Kit	26353-00
23	20	Brush, Test Tube	6900
24	10	Syringe, Luer-Lock Tip, plastic, disposable, 1 mL with 0.1 mL divisions	12263-00
25	2	Distilled Water Bottles, 4L	-
26	2	General Laboratory Cleaner (phosphate free), 4 L bottle	-
27	1	Logbook with Reproducible Log Sheets	-
28	8	Boxes of lint-free wipes (100 per box)	-
29	1	Wash tub, 10 L plastic	-
30	3	Fire Extinguishers, Class BC, UL listed, 9 kg capacity, external	-
31	2	Pairs of Safety Goggles	-
			-

Part 3 Execution

3.1 STORAGE AND DELIVERY

.1 Store spare parts and equipment in shelf units.

.2 Owner must accept supply of all spares and supplies prior to final inspection. The project will not be considered final until all spares and equipment have been received and accepted by Owner.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes identification requirements of equipment, motors, vessels, valves, ferrous, non-ferrous and insulating piping.

1.2 RELATED SECTIONS

.1 Section 15 10 00 - Process Piping.

.2 Section 15 11 00 - Process Valves.

Part 2 Products

2.1 EQUIPMENT - MANUFACTURER'S NAMEPLATES

.1 Provide metal nameplate and/or lamacoids on each piece of equipment, mechanically fasten with raised or recessed letters.

.2 Provide Underwriter's Laboratories and/or CSA registration plates as required by respective agency.

.3 Manufacturer's nameplates to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motor.

2.2 EQUIPMENT - PROJECT IDENTIFICATION

.1 Supply and install black lamacoid identification plates for all equipment installed under this contract. The identification shall consist of the unit name and equipment number in 12 mm high lettering and electrical characteristics, if applicable, in 6 mm high lettering. For example:

Raw Water Pump	12 mm lettering
RWP1	12 mm lettering
115V/1 ph/60 Hz	6 mm lettering
Circuits MCC#, #, #	6 mm lettering

.2 Submit a list of plates for review prior to engraving.

2.3 VALVES

.1 All valves shall contain a 32 mm diameter brass tag with 12 mm black engraved numbers complete with non-ferrous chains.

.2 Consecutively number valves in distinct systems in accordance with the process schematic drawings. Refer to Drawing 201.

.3 Furnish a directory consisting of a typewritten valve list showing the tag number, location of the valve and its use. The directory may be made up in sections to suit the respective plant area or system.

.4 Mount one copy of these lists in glazed frames as directed by the Engineer. Provide lists in the Operating and Maintenance Manual.

2.4 PIPING

.1 All piping installed shall be identified with pipe markers designating the pipe service and direction of flow.

.2 Pipe markers may be self-adhesive, plastic coated cloth labels provided that each marker is secured, in addition to its adhesive, with a full tape band at each end of the label.

.3 Direction arrows are to be 150 mm long by 50 mm wide for piping with an outer diameter of 75 mm or larger, including insulation. Use 100 mm long by 20 mm wide for smaller diameters direction arrows. Provide double headed arrows where appropriate.

.4 Block capital letters are to be used for names, 50 mm high for piping with an outer diameter 75 mm or larger, including insulation. Use 20 mm high for smaller diameters. Pipe fluid codes shall be used as detailed on drawings.

.5 Use plastic marker tags for pipes and tubing with an outer diameter 20 mm and smaller.

2.5 COLOR CODING

.1 Color coded system identification shall be carried out on the following items:

.1 Steel piping.

.2 Valves.

.2 Identification shall consist of the following:

.1 Full coating of pipes and valves to the color of medium being conveyed.

.2 Non-submerged process equipment shall be coated to match the color requirement of material being processed.

.3 Valve handles, chain wheels and similar appurtenances shall be black.

.3 Identification colors shall be in accordance with the following schedule. The code numbers are as defined in CGSB 1-GP-12C.

Medium	Color	ID Code	Abbreviation
Raw Water Supply	Light Blue	502-106	RW
Treated Water	Green	503-107	TW
Hypochlorite	Yellow	505-102	CL
Domestic Cold Water	Green	503-107	DCW
Domestic Hot Water	Dark Blue	202-101	DHW
Fuel Oil Supply	Yellow	505-101	FOS
Fuel Oil Return	Yellow	505-101	FOR
Instrumentation	Grey	505-107	SA, DA
Vents	Same color as line being vented		VENT
Sample Line	Same color as line being sampled		SAM
Wastewater	Brown		WW

Part 3 Execution

3.1 EQUIPMENT - MANUFACTURER'S NAMEPLATES

.1 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.2 EQUIPMENT - PROJECT IDENTIFICATION

.1 Identification (ID) plates shall be attached to the equipment with sheet metal screws or nuts and bolts. Adhesive is not acceptable.

.2 Fasten plates in conspicuous locations. Where plates cannot be mounted on hot or cold surfaces, provide standoffs.

3.3 VALVES

.1 Attach brass tags to all valves with supplied chains. Ensure tags are easily accessible and do not conflict with valve operation.

3.4 PIPING

.1 On completion of protective coatings or finish painting, neatly apply, in a contrasting color, direction flow arrows and pipe service at the following locations:

- .1 At each valve.
- .2 On both sides of wall penetrations.
- .3 At floor and roof penetrations.
- .4 On each leg of branches.
- .5 On every 15 m along continuous runs of pipe and every run of pipe over 3 m.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section describes the requirements for the disinfection of water retaining structures and piping. Lab results shall be submitted to Engineer.

1.2 RELATED SECTIONS

.1 Section 15 01 00 - Process Description.

1.3 RELATED CODES

.1 AWWA C651-99 Disinfecting Water Mains

.2 AWWA C652-02 Disinfection of Water Storage Facilities

.3 AWWA C653-97 Disinfection of Water Treatment Plants

1.4 COORDINATION

.1 Coordinate with other Divisions to ensure there are no conflicts in Work.

1.5 SCHEDULE OF ITEMS TO BE DISINFECTED

.1 Contractor shall disinfect all items which will be used for the conveyance or storage of potable water. These include but are not limited to the following structures and piping:

.1 All pipework conveying potable water, including but not necessarily limited to:

.1 Transfer piping to and from treated water storage tank.
.2 Treated water storage tank.
.3 Suction piping to all pumps.
.4 Discharge pipework from truck fill pumps.
.5 Plant service water lines.
.6 Cartridge filter housings.

Part 2 Products

2.1 WATER

.1 Water for disinfection shall be provided by Contractor. The treated (chlorinated) water shall be free from all suspended and deleterious material.

2.2 HYPOCHLORITE

.1 Calcium hypochlorite pucks shall be supplied and comply with AWWA B-300.

.1 Quantity: 1 year supply
.2 Size (per tablet):

.1 Diameter: 76.2 mm (3")

.2 Thickness: 31.75 mm (1 ¼")

.3 Strength: minimum 65% available chlorine

Part 3 Execution

3.1 CLEANING

.1 All tanks and pipework to be disinfected shall be thoroughly cleaned prior to disinfection.

.2 All construction material not part of the permanent structure shall be removed.

.3 Surfaces of walls, floor and roof of structures shall be cleaned using a high pressure jet, sweeping, scrubbing or equally effective means.

.4 Pipes shall be flushed to remove all dirt prior to disinfection. If necessary, the pipe shall be cleaned by swabbing or other mechanical means as directed by the Engineer.

3.2 DISINFECTION OF PIPING

.1 Pipework shall be disinfected by adding a chlorine compound to the filling water during the pipe pressure test to produce an initial even concentration of at least 25 mg/L of free chlorine. The pipes shall be left full of chlorinated water for 24 hours and the free chlorine residual after 24 hours shall not be less than 10 mg/L.

.2 If the chlorine residual is less than 10 mg/L after 24 hours, the main shall be flushed and the procedure repeated.

3.3 DISINFECTION OF STRUCTURES

.1 Structures and tanks shall be disinfected using either of the following two (2) methods:

.1 Structure or tank shall be filled to the overflow level with water, with an initial even concentration of at least 25 mg/L of free chlorine. After 24 hours, the free residual shall be at least 10 mg/L. If not, then the procedure shall be repeated.

.2 A solution of 200 mg/L available chlorine shall be applied directly to the surface of all parts of the tank or structure including the underside of the roof. The solution shall be applied by suitable brushes or spray equipment and shall thoroughly coat all surfaces. The disinfected surfaces shall remain in contact with the solution for at least 30 minutes.

3.4 DISPOSAL OF CHLORINATED WATER

.1 After the disinfection process is complete, the heavily chlorinated water shall be drained and disposed of in an approved manner.

.2 Heavily chlorinated water shall be discharged to local sewage disposal area.

.3 If other disposal methods are impractical, de-chlorinate the water using methods outlined in AWWA C653-97.

3.5 BACTERIOLOGICAL TESTING

.1 After chlorination procedure has been completed and piping tank or structure has been refilled with potable water, supplicate samples shall be taken at least 30 minutes apart and shall be tested for coliforms in accordance with Standard Methods for the Examination of Water and Wastewater.

.2 For piping, a minimum of one (1) sample shall be collected from each line disinfected.

.3 Bacteriological testing shall be performed at the nearest available hospital that is able to perform the tests. Stanton Hospital, located in Yellowknife, NT is suggested. Transportation of samples is at the expense of the Contractor.

.4 Forward results of the bacteriological testing to the Engineer.

3.6 DISINFECTION

.1 If initial disinfection fails to produce satisfactory bacteriological samples, the main or tank may be re-flushed and re-sampled.

.2 If check samples show the presence of coliform organisms, then the main or tank shall be re-disinfected until satisfactory results are obtained.

.3 All costs associated with the re-disinfection and testing shall be borne by Contractor.

3.7 PLACING INTO SERVICE

.1 No piping, structure or tank that is required to be disinfected shall be placed into service until bacteriological samples indicate the absence of contamination.

END OF SECTION

DILLON CONSULTING LIMITED

Equipment Specification Sheet

Client:	Government of Nunavut Department of Community and Government Services	Device Name:	Cartridge Filtration
Project Name:	Arviat Water Supply Filtration System	Device Location:	Process/Intake Room
Project Number:	07-8254	Tag No:	

Inflow Design Rate:	1,350 L/min	Maximum Inflow Rate:	1,704 L/min
Filter Height:	Depends on filter housing HUR 3x170FL: 1.63 m (64") HUR 5x170FL: 1.88 m (74") Service Requirements: 2.50 m (98½")	Filter Diameter:	Depends on filter housing HUR 3x170FL: 0.56 m (22") HUR 5x170FL: 0.81 m (31¾")
Filter Cartridge:	1 filter tank for 20 µm cartridge 1 filter tank for 5 µm cartridge 1 filter tank for 1 µm cartridge 1 filter tank for 5 µm cartridge with activated carbon block		
Number of Tanks:	4 in total 1 tank - HUR 3x170FL 3 tanks - HUR 5x170FL	Number of Filters per Tank:	Depends on filter housing 3 for HUR 3x170FL 5 for HUR 5x170FL
Material:	Stainless Steel		

Tank Fittings

Manhole	Removable Top, Swing bolt	Effluent Valves	50 mm	
Influent Valves	100 mm	Drain Valves	40 mm	

Metering

Flow Metering:	Each filter		Signet Local Display:	
Pressure Gage:	Each filter		Bourdon Tube Pressure Gauge:	Type 212.5, 150 mm Dial Size 0 - 60 psi

Notes:	Standard of Acceptance: Harmsco® Hurricane® Swing Bolt Housings HUR 3x170FL HUR 5x170FL

DILLON CONSULTING LIMITED Equipment Specification Sheet					
Client:	Government of Nunavut Department of Community and Government Services		Device Name:	Pre-filter Screen	
Project Name:	Arviat Water Supply Filtration System		Device Location:	Process/Intake Room	
Project Number:	07-8254		Tag No:		
Filter Size:	4" for both inlet and outlet connections		Inflow Design Rate:	1,350 L/min	
Filter Material:	PVC		Maximum Inflow Rate:	1,704 L/min	
Number of Filters:	1		Number of Baskets per Filter:	1 (include 2 spare baskets)	
Basket Material:	Stainless Steel, 316		Basket Screen Size:	75 µm (200 mesh)	
Tank Fittings					
Manhole:	Removable Top				
Influent Valves:	100 mm				
Effluent Valves:	100 mm				
Drain Valves:	100 mm				
Metering					
Flow Metering:	Each filter		Signet Local Display:		
Pressure Gage:	Each filter		Bourdon Tube Pressure Gauge:	Type 212.5, 150 mm Dial Size 0 - 60 psi	
Notes:			Standard of Acceptance: Hayward® Simplex Basket Strainers		

Division 17

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Spare parts.
.2 Laboratory equipment.
.3 Miscellaneous equipment.

Part 2 Products

2.1 GENERAL

.1 Supply the spare parts and equipment listed herein.

.2 All spare parts are to be identical make and model as the components supplied in other parts of this project.

2.2 SPARE PARTS

.1 Supply the following spare parts:

Spare Component	Parts
Intake and Process Pumps	One (1) pump complete with power cable. One (1) spare pump of each type installed.
Disinfection Feed System and Chemical Pump	One (1) rebuild kit for chemical pumps. Two (2) chemical feed pumps. Two (2) chlorine mixing pumps. Two (2) chlorine flow switches. Nylon tubing.
Eyewash	One (1) spare container of solution.
Lighting, Exterior and Interior	Six (6) spare lamps of each type installed. One (1) case of all fluorescent lamps of each type and size installed.
Distribution Panel	Two (2) breakers of each size and type.
Terminal Blocks	One (1) set of blocks for each size and type installed. End caps, end plates, cross connectors and tear-off markers are to be included.
Fuses	Twelve (12) spares of each type installed, unless otherwise noted.
Valves	Two (2) spare gaskets and valve seats for each type of valve installed. One (1) spare of each valve installed.
Motor Starters	Two (2) of each type of pilot light. One (1) of each type.
Control Devices	Two (2) push buttons, 6 pilot lights and 2 lens for each type. One (1) spare flow display/totalizer. One (1) spare flow sensor.

Spare Component	Parts
Alarm Panel	One (1) alarm annunciator.
Mini-Breaker (or six (6) of each fuses)	Two (2) of each relay and timer. One (1) of each relay and timer base.
Fan Belts	One (1) of each type installed.
Thermostats	One (1) spare of each type installed.
Fire Extinguisher	One (1) per room.
Miscellaneous	2-20L of 65% Calcium Hypochlroite Timers.

2.3 MISCELLANEOUS EQUIPMENT

.1 Supply the following miscellaneous equipment:

.1 1 - Fire Extinguisher (one mounted in room): Class BC, UL listed, 9 kg capacity, external nitrogen cartridge Foray powder with wall mounting brackets. Mount on wall near entrance door of each room.

.2 2 pairs of Goggles

.3 2 sets of Respirator

.4 2 ear defenders.

.5 Gloves: Twelve (12) Fisher 11-394-30, large, extra long, heavyweight rubber gloves, 19 mm by 380 mm length.

.6 Apron: Two (2) Fisher 01-357 double coated abrasion resistant, rubberized cloth apron.

.7 Push Broom and dust pan.

.8 Mop, mop bucket and wringer.

.9 Garbage Can: One (1) 100 L, galvanized, with cover.

.10 Floor Cleaner.

.11 Four (4) liters of distilled water.

.12 One (1) eye wash station and one (1) first aid kit.

.13 Step ladder 2.0 meters.

.14 Electronic Scale – range 0 to 250 grams, accuracy of +/- 0.1%

.15 Two (2) years supply of cartridges.

.16 Laboratory and safety equipment as listed in the table below.

.17 First Aid Kit that meets requirements of the NU Workers Compensation Board at time of installation.

2.4 LABORATORY EQUIPMENT

.1 Supply laboratory equipment in accordance with Section 15 68 50 - Laboratory Equipment.

Part 3 Execution

3.1 GENERAL

.1 Store spare parts and equipment in shelf units.

.2 Parts to be neatly labelled with product information including:

- .1 Manufacturer's name;
- .2 Type of component;
- .3 Catalogue number;
- .4 Component rating (amps, volts, etc.)

.3 Owner must accept supply of all spares and supplies prior to final inspection. The project will not be considered final until all spares and equipment have been received and accepted by Owner.

END OF SECTION

Division 21

Part 1 General

1.1 SUBMITTALS

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

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.4 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Engineer 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: Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .1 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.

.2 Make changes as required and re-submit as directed by Engineer.

.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 Engineer will provide 1 set of white prints. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 Record drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of record drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Engineer for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible record drawings with Operating and Maintenance Manuals.

.10 Submit copies of record drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

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

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.3 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Execution

2.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

2.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

2.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

2.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

1.2 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:

.1 CPF: Code Piping Finish.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.3 Shop Drawings:

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

.4 Samples:

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

.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.2 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project.

.3 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702.

2.3 JACKETS.

.1 Stainless steel:

.1 Type: 304.

.2 Thickness: 0.25 mm.

.3 Finish: smooth.

.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.

.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.

.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: C-2 with vapour retarder jacket.

.1 Seals: lap seal adhesive, lagging adhesive.

.2 Installation: TIAC Code: 1501-C.

.3 Thickness of insulation as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Applica-tion	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic CWS with vapour retarder		C-2	25	25	25	25	25	25

.4 Finishes:

.1 Exposed in mechanical rooms: SS jacket.

.2 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.3 Outdoors: water-proof SS jacket.

.4 Finish attachments: SS bands, at 150 mm on centre. Seals: closed.

.5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Division 22

Part 1 General

1.1 SUBMITTALS

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

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Engineer 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 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.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.

.2 Make changes as required and re-submit as directed by Engineer.

.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 Engineer will provide 1 set of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 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 Engineer for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible 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 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

.3 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One glass for each gauge glass.

.4 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.5 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Execution

2.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

2.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

2.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

2.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Related Sections:

.1 Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.
.2 Section 01 33 00 - Submittal Procedures.
.3 Section 01 35 30 - Health and Safety Requirements.
.4 Section 01 45 00 - Quality Control.
.5 Section 01 78 00 - Closeout Submittals.
.6 Section 02 61 33 - Hazardous Materials.

1.2 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Coordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.

.3 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
.2 Submit WHMIS MSDS in accordance with Section 02 61 33 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.4 Shop Drawings.

.1 Submit shop drawings to indicate:
.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
.2 Wiring and schematic diagrams.
.3 Dimensions and recommended installation.
.4 Pump performance and efficiency curves.

.5 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: Submit manufacturer's installation instructions.

.7 Manufacturers' Field Reports: Manufacturers' field reports specified.

.8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning on-site installations in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

.3 Construction requirements: In accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.4 Verification: Contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

Part 2 Products

2.1 MATERIALS

2.2 DOMESTIC WATER BOOSTER PUMP

.1 Capacity: 3.3 usgpm against total differential head of 45 psi.

.2 Construction: three (3) chambered diaphragms, polypropylene housing, santophrene diaphragm, and zinc-plated hardware. Design for 45 psi and 54 degrees C continuous service.

.3 Motor: 0.9 Amp, 115 VAC, drip-proof, with thermal overload protection.

.4 Supports: provide as recommended by manufacturer.

.5 See the Equipment Schedule, Drawing E-4

2.3 SUMP PUMP SYSTEM

.1 Capacity: 25 uspgm at 12’ head with NPS 1 1/2” Ø discharge.

.2 Construction: simplex CSA approved, housing epoxy coated cast iron, stainless steel, stainless steel shaft, non-clog bronze impeller, mechanical shaft seal, polypropylene basic and cover.

.3 Motor: 1/3 hp, 115 volt, 1" Ø indicated.

.4 See Equipment Schedule, Drawing E-4.

2.4 SUBMERSIBLE INTAKE WATER PUMP SYSTEM

.1 Packaged system, factory assembled, tested and adjusted, ready for site installation and electrical connections.

.2 Construction: stainless steel shaft sleeve, mechacnical shaft seal, designed for 850 kPa suction pressure.

.3 Modify existing control panel to accommodate the new filtration system and larger pumps.

.4 See Equipment Schedule, Drawing E-4.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.
.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

.6 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

.1 Materials and resources.
.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Certified wood.

.8 Low-emitting materials.

3.4 START-UP

.1 General:

.1 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.6 Adjust alignment of piping and conduit to ensure full flexibility.

3.5 TRAINING

.1 In accordance with Section 01 91 00 - Commissioning: Training of O&M Personnel, supplemented as specified.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for copper domestic water service used in the following:

.1 Hard drawn copper domestic cold water services inside building.

.2 Soft copper tubing inside building.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 02 61 33 - Hazardous Materials.

.3 Section 01 35 30 - Health and Safety Requirements.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 01 91 00 - Commissioning.

.6 Section 33 11 17 - Site Water Utility Distribution Piping.

.7 Section 23 05 00 - Common Work Results - Mechanical.

.8 Section 23 05 01 - Installation of Pipework.

.9 Section 23 05 22 - Valves - Bronze.

.10 Section 23 05 23 Valves - Cast Iron: Gate, Globe, Check.

1.3 REFERENCES.

.1 Canadian Standards Association (CSA International).

.1 CSA B242-M1980(R1998), Groove and Shoulder Type Mechanical Pipe Couplings.

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.4 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

1.4 SUBMITTALS

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

□

.2 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type K: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.2 Cast copper, solder type: to ANSI/ASME B16.18.

.3 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 22 - Valves - Bronze.

2.5 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

□

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 22 - Valves - Bronze.

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 22 - Valves - Bronze.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Territories Plumbing Code and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05- Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 23 05 00 - Common Work Results - Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.4 DISINFECTION

.1 Flush out, disinfect and rinse system to Engineer.

3.5 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Reports:

□

.1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

□

Part 1 General

1.1 SUMMARY

.1 Related Sections:

.1 Section 01 35 30 - Health and Safety Requirements.
.2 Section 23 05 01 - Installation of Pipework.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-B181.2-02, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
.2 CSA-B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 For above ground DWV piping to:

.1 CSA-B181.1.
.2 CSA-B181.2.
.3 CSA-B182.1.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 01 - Installation of Pipework.

.2 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

Division 23

Part 1 General

1.1 SUBMITTALS

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

.2 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Points of operation on performance curves.
- .3 Certification of compliance to applicable codes.

.4 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Engineer 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 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.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless directed by Engineer.

.2 Make changes as required and re-submit as directed by Engineer.

.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.

1.2 QUALITY ASSURANCE

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

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.3 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One set of packing for each pump.

.2 One casing joint gasket for each size pump.

.3 One head gasket set for each heat exchanger.

.4 One glass for each gauge glass.

.5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Execution

2.1 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

2.2 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

2.3 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 11 - Cleaning.

.2 Section 07 84 00 - Firestopping.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 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 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Install air vents 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 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible [and as indicated].

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated.

.14 Valves:

.1 Install in accessible locations.

.2 Remove interior parts before soldering.

.3 Install with stems above horizontal position unless otherwise indicated.

.4 Valves accessible for maintenance without removing adjacent piping.

.5 Install globe valves in bypass around control valves.

.6 Use gate, ball, or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.

3.7 SLEEVES

.1 General: Install where pipes pass through walls.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and un-insulated 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: Provide space for firestopping. 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.

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. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 FLUSHING OUT OF PIPING SYSTEMS

.1 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant sections of Division 15.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Engineer 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 15.

.3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer period of time in relevant sections of Division 15.

.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 Engineer.

.6 Pay costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Engineer.

3.11 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Engineer.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Bronze - valves.

.2 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 35 30 - Health and Safety Requirements.
.3 Section 01 78 00 - Closeout Submittals.
.4 Section 23 05 01 - Installation of Pipework.

1.2 REFERENCES

.1 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
.2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
.3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
.2 Submit data for valves specified in this section.

.3 Closeout Submittals:

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 MAINTENANCE

.1 Extra Materials:

.2 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.

Part 2 Products

2.1 MATERIALS

.1 Valves:

.1 Except for specialty valves, to be single manufacturer.

.2 All products to have CRN registration numbers.

.2 End Connections:

.1 Connection into adjacent piping/tubing:

.1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.

.2 Copper tube systems: Solder ends to ANSI/ASME B16.18.

.3 Gate Valves:

.1 Requirements common to gate valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Packing: non-asbestos.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.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 B62..

.5 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.6 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.

.2 Pressure rating: Class 12.

.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.

.4 Disc and seat: renewable rotating disc.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

.7 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class125.

.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders.

.4 Ball and seat: replaceable stainless steel solid ball and teflon seats.

.5 Stem seal: TFE with external packing nut.

.6 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Provide documentation confirming qualifications, successful experience.

.2 TAB: performed in accordance with the requirements of standard under:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.3 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.4 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.5 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.6 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.7 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

1.4 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

1.5 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.6 START OF TAB

.1 Notify Engineer 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

1.7 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 5 %, minus 5 %.

1.8 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.9 INSTRUMENTS

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

1.10 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.11 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit 6 copies of TAB Report to Engineer for verification and approval, in English in D-ring binders, complete with index tabs.

1.12 SETTINGS

.1 After TAB is completed to satisfaction of Engineer, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.13 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Engineer.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with sealant tape or combination thereof.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.4 FITTINGS

.1 Fabrication: to SMACNA.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA

.3 Joints: to SMACNA.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA.

.4 Manufacture duct in lengths to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

3.3 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

3.4 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Ceiling mounted discharge fans for domestic use.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors Association (AMCA)

.1 AMCA 201-02, Fans and Systems.

1.3 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

Part 2 Products

2.1 FANS - GENERAL

.1 Standard of rating:

.1 AMCA 201 for fan application.

.2 AMCA 302 for application of sone loudness ratings for non-ducted air moving devices.

.3 AMCA 303 for application of sound power ratings for ducted air moving devices.

.4 Performance: to ANSI/AMCA 210. Unit to bear AMCA certified seal.

.5 See the Equipment Schedule E-4

2.2 WALL AND CEILING DISCHARGE FANS

.1 Centrifugal suitable for ceiling installation, zinc coated rectangular metal housing.

.2 Toggle switch operated complete with integral electrical outlet box.

.3 Duct outlet with integral backdraft damper.

.4 Grille.

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 manufacturer's recommendations.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Supply for installation by other divisions.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Return register for commercial and residential use.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

Part 2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: as directed by Engineer.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Type RB: steel 19 mm border, single 45 degrees deflection, vertical face bars.

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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

Part 2 Products

2.1 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.6 Screen: 12 mm exhaust mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.7 Finish: factory applied enamel,. Colour: to Engineer's approval.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Division 26

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements that are common to NMS sections found in Division 26 - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-02, Canadian Electrical Code- 2006, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.4 SUBMITTALS

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

.2 Submit for review single line electrical diagrams under plexiglass and locate in LS #1.

.1 Electrical distribution system in main electrical room.

.3 Shop drawings:

.1 Submit six (6) 600 x 600 mm minimum size drawings and product data to Engineer.

.2 If changes are required, notify Engineer of these changes before they are made.

.4 Manufacturer's Field Reports: submit to Engineer manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing.

1.5 QUALITY ASSURANCE

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

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Engineer with schedule within 2 weeks after award of Contract.

1.7 SYSTEM STARTUP

.1 Instruct Engineer and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 – Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - Submittals.

Materials and equipment to be certified by Electrical and Electronic Manufacturers' Association of Canada (EEMAC).

.3 Materials and equipment to be certified by National Electrical Manufacturers Association (NEMA).

.4 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Engineer.

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, black matt white finish face.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, [numbered] [coloured plastic tapes], on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1 and Electrical System Identification Tables E1 & E 2 "GBPG" Ed 2 Dec. 2005 Section 3.4.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, 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 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.2 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Refer to Government of Nunavut - "GBPG" Ed 2 Dec. 2005 Sec.3.4.1 E1.

.2 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.3 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.4 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Panelboards: as required by Code or as indicated.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Carry out tests in presence of Engineer.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 American National Standards Institute (ANSI)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.
- .4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

.3 Government of Nunavut - "GBPG" Ed 2, Dec.2005- Sec.5.1 & 5.2.

1.3 PRODUCT DATA

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

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section [01 74 19 - Construction/Demolition Waste Management And Disposal], and with the Waste Reduction Workplan.

.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 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.3 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket,.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16.
.2 In underground ducts in accordance with Section 16.
.3 In trenches in accordance with Section 16.
.4 In cellular floor raceways in accordance with Section 16.
.5 In surface and lighting fixture raceways in accordance with Section 16.
.6 In wireways and auxiliary gutters in accordance with Section 16.
.7 Overhead service conductors in accordance with Section 16.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Install cable in trenches in accordance with Section 16.

.3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

Part 2 Products

2.1 EQUIPMENT

.1 Insulated grounding conductors: green.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment including: Service equipment, transformers, starters, control panels, distribution panels.

3.3 PERMAFROST

.1 Bond non-current carrying metal parts together with size 6 AWG copper equipotential conductor:

.2 Drive 19 mm diam x 3 m copper clad ground rods at least 1.8 m apart in original undisturbed ground. If rods will not penetrate permafrost, drive at angle not more than 60^{o} from vertical, and in same direction. Rods must be driven, not trenched.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1, Canadian Electrical Code - 2006, Part 1, 20th Edition.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.4 CONDUIT BOXES

.1 Cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.5 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.2 CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

2.2 CONDUIT FASTENINGS

.1 One hole malleable iron straps to secure surface conduits NPS 2 and smaller. Two hole steel straps for conduits larger than NPS 2.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

.3 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm planks pressure treated with clear coloured, or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

.1 Cedar post type markers: 89 x 89 mm, 1.5 m long, pressure treated with clear coloured, or copper napthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.

.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After sand bed specified in Section is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Make termination and splice only as indicated leaving 0.6 m of surplus cable in each direction.

.1 Make splices and terminations in accordance with manufacturer's instructions using approved splicing kits.

.4 Underground cable splices not acceptable.

.5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.6 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

3.2 MARKERS

.1 Mark cable every 150 m along cable runs and changes in direction.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Install cedar post type markers.

.5 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing at 100% of original factory test voltage in accordance with ICEA recommendations.

.4 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by ICEA for type of cable being tested.

.2 Hold maximum voltage for specified time period by ICEA.

.3 Record leakage current at each step.

.7 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 06 10 11 – Rough Carpentry – Short Form. Plywood Backboard.

.3 Section 26 05 01 – Common Work Results – Electrical.

.4 Section 26 28 21 – Moulded Case Circuit Breakers.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 013300-Submittal Procedures.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 100 A (summetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere ratings as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 BREAKERS

.1 Breakers: to Section 262821-Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 260500-Common Work Results – Electrical.

.2 Nameplate for each panelboard size4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 260500-Common Work Results – Electrical, or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2No.248.12-94 , Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Six spare fuses of each type and size installed up to and including 600 A.

Part 2 Products

2.1 FUSES GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer for entire project.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 15 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 013300 – Submittal Procedures.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 30 – Health and Safety Requirements.

.3 Sections 26 05 01 – Common Work Results – Electrical.

.4 Section 26 28 14 – Fuses – Low Voltage.

1.3 SUBMITTALS

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

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 10 35 30 – Health and Safety Requirements.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible or non-fusible or horsepower rated disconnect switch in CSA.

.2 Provision for padlocking in on-off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.5 Quick-mate, quick-break action.

.6 ON-OFF switch position indicated on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 260500 Common Work Results – Electrical.

.2 Indicate name of load and controlled on size 4 template.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC)

.1 JEC 60947-4-2, Part 4-2 – Contactors and Motor Starters – A-C Semi-Conductor Motor Controllers and Starters

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include operation and maintenance data for each type and style of starter.

Part 2 Products

2.1 MATERIALS

.1 Starters: to IEC 60947-4 with AC4 utilization category.

2.2 ELECTRIC MOTOR CONTROLLERS

.1 Electronic Motor Controller – Soft starter, size, ratings, and enclosure as indicated. Starter suitable for pump control and with components as follows:

.1 3-pole electronic motor controller.
.2 Internal bypass contactor to bypass the SCR’s after acceleration.

.2 The soft starter should have the following standard performance features:

.1 Soft start with standard voltage ramp
.2 Pump control capabilities

.3 Current Limit

.4 Initial Voltage

.3 The soft starter should have the following motor protection features as standard:

.1 Electronic overload

.2 Phase loss

.3 Over Temperature

.4 The soft starter should have the following inputs and outputs as standard:

.1 Start and stop control via a voltage free contact

.2 End of acceleration contact

.3 Fault contact

.5 The soft starter should have the following use adjustments:

.1 Otor full load amp adjustable from 50 to 100% of the soft starters full load amp rating

.2 Ramp-up time adjustable from 2 to 30 seconds

.3 Ramp-down time adjustable from 0.2 to 30 seconds

.4 Initial voltage adjustable from 10 to 50% of nominal voltage

.5 Current limit adjustable from 100 to 400% of motor full load amps

.6 The soft starter shall have the following means of monitoring:

.1 LED indicators for On, Ramp Up/Down, Run, Overload, Phase Loss, and Over Temperature

.7 The soft starter shall meet the following electrical ratings:

.1 Main voltage supply

.2 575 Volts; +10% / -15%

.3 No control power required or integral control transformer

.4 Frequency: 60 Hz

.5 Output contacts: Two N.O. contacts rated at 8A, 250 VAC, 2000 VA

.8 The soft starter shall meet the following construction requirements:

.1 The soft starter must be of heavy-duty construction, designed to operate at 300% (400%) current for 30 (5) seconds at 40 C

.2 Soft starter should have an internal bypass contactor to bypass the SCR's after acceleration

.9 The soft starter shall be able to operate continuously in the following environmental conditions:

.1 Temperature ratings:

.1 Operating Temperatures: -10 C to +40 C

.2 Storage Temperature: -20 C to +70 C

.2 Humidity should not exceed 93% (non-condensing)

.3 Altitude of up to 3300 feet (1000 m)

2.3 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.4 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, engraved.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated. New soft starters to be installed in existing motor starter enclosures.

.2 Ensure correct fuses and overload devices elements installed (Type 2 Co-ordination)

.3 Configure soft starter parameters, perform setup functions.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 a)

.2 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.

.2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 Illuminating Engineering Society (IES)

.4 Model National Energy Code -- (MNECB) 1997

.5 Government of Nunavut - “GBPG" Ed 2 Dec.2005

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section [01 33 00 - Submittal Procedures].

.2 Photometric data to include: VCP Table.

Part 2 Products

2.1 LAMPS

.1 See Luminaire Schedule, Drawing E-4.

2.2 INTERIOR CONNECTED LIGHTING

.1 The total Interior Connected Lighting Power (ICLP) as determined should not exceed the value of the interior lighting power allowance (ILPA) as per building type or by space function.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

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3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Through rigid conduit for luminaire designs.

3.3 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 21 – Wires and Cables (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment fo Emergency Lighting.

1.4 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 Compete unit one (1) year, batteries, ten (10) years.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120

.3 Battery: sealed, maintenance free.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

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END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 Canadian Code for Preferred Packaging

.2 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141- M1985(R1992) , Unit Equipment for Emergency Lighting.

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittals.

.2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines and match existing in building.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit lights.

.2 Connect fixtures to exit light circuits.

.3 Connect emergency lamp sockets to emergency circuits.

.4 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION