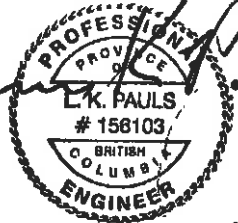

KITIMAT RIVER HATCHERY
AERATION TOWER MODIFICATIONS

Specifications

March 2014

L. K. Pauls

3-26-14

DFO Contract No. F1700-130721



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada

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END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract includes the procurement and modification to existing piping, a head tank aeration system, metal framing, and the procurement and installation of new electrically actuated control valves and gates at the Kitimat River Hatchery (the Hatchery). This is an operating production Hatchery that must remain operational during the entire construction project. The project is located at the Kitimat River Hatchery, Kitimat, BC V8C 2G7

1.2 CONTRACT METHOD

- .1 Construct Work under single, stipulated price contract.

1.3 FUTURE WORK

- .1 Not Used

1.4 WORK SEQUENCE

- .1 Construct work in stages to accommodate the Department's continued use of premises during construction.
- .2 Coordinate progress schedule with the Department's occupancy during construction.
- .3 Construct work in stages to allow for continuous use of the Hatchery. At no time can the Hatchery be left without an operational alarm system and an alarm annunciation system.
- .4 Maintain fire access/control.

1.5 CONTRACTOR USE OF PREMISES

- .1 Restricted use of the construction site.
- .2 Limit use of premises for storage and to allow:
 - .1 Department occupancy and rearing of fish.
- .3 Coordinate the use of premises under direction of Hatchery Staff and Department Representative.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 DEPARTMENT OCCUPANCY

- .1 Department will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Department in scheduling operations to minimize conflict and to facilitate Department usage.

1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to Hatchery operations, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.8 EXISTING SERVICES

- .1 Notify Using Agency and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services (especially the aeration tower), obtain approval from the Departmental Representative in advance, for necessary interruption of mechanical, electrical, communication, or alarm service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to Hatchery operations. Normal operating hours of the facility are from 8:00am – 4:30pm, Monday thru Friday.
- .3 Provide alternative routes for personnel and vehicular traffic.
- .4 Submit schedule to and obtain approval from Department Representative for any shut-down or closure of active service or facility including power, communications, and alarm services. Adhere to approved schedule and provide notice to affected parties.
- .5 Provide temporary services to maintain critical Hatchery systems and operations.
- .6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.
- .10 Construct temporary barriers and enclosures as required

1.9 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.
- .11 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 RELATED SECTIONS

- .1 Not Used.

1.2 ADMINISTRATIVE

- .1 The contractor shall be responsible for the following administrative tasks.
- .2 Schedule and administer project meetings throughout the progress of the work.
- .3 Prepare agenda for meetings.
- .4 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.
- .5 Provide physical space and make arrangements for meetings.
- .6 Preside at meetings.
- .7 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .8 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .9 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, the contractor will organize a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, and field inspectors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing contract.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedule.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

- .4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
- .5 Delivery schedule of specified equipment in accordance with Section 01 32 16.07- Construction Progress Schedule.
- .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .7 Departmental Representative provided products.
- .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.4 PROGRESS MEETINGS

- .1 The Contractor will be responsible for facilitating Bi-weekly progress meetings during the course of the project.
- .2 During course of Work and weeks prior to project completion, schedule progress meetings bi-weekly.
- .3 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance. Parties may attend via teleconference with Departmental Representative's approval in advance.
- .4 Notify parties minimum 5 days prior to meetings.
- .5 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .6 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

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 Not used.

1.2 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Sunday, inclusive, will provide seven day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Contractor: The following terms shall mean the Contractor or others engaged in the Work on the Contractor's behalf: Contractor, Subcontractor, and Fabricator.
- .6 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .7 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .8 Milestone: significant event in project, usually completion of major deliverable.
- .9 Departmental Representative: Department of Fisheries and Oceans (DFO) Canada
- .10 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .11 Project Planning, Monitoring and Control System: overall system to enable monitoring of project work in relation to established milestones.

1.3 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

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

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Project Schedule to Departmental Representative within 10 working days of Notice to Proceed.

1.5 PROJECT MILESTONES

- .1 All work including cleanup and demobilization shall be completed with twelve (12) weeks after the date the contract is awarded.

1.6 PROJECT SCHEDULE

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Develop detailed Project Schedule derived from Master Plan.
- .5 Ensure detailed Project Schedule includes as a minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Mobilization.
 - .4 Demolition.
 - .5 Electrical Interconnection and Controls Integration.
 - .6 Piping.
 - .7 Testing and Commissioning.
 - .8 Supplied equipment long delivery items.
 - .9 Demobilization and cleanup

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current 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 will be at the contractor's expense.

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 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 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 Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, 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 is co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 SPEC NOTE: If a Supplementary Condition has been written to delete the requirements of CCDC 2, GC 3.11, use the following seven paragraphs.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.
- .4 All drawing submittals shall conform to ANSI standards.
- .5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion

of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .6 Allow 14 days for Departmental Representative's review of each submission.
- .7 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .8 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .9 Accompany submissions with transmittal letter, in 5 copies, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .10 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .11 After Departmental Representative's review, distribute copies.

- .12 Submit 4 prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .13 Submit 4 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .14 Submit 4 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .15 Submit 4 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .16 Submit 4 copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .17 Submit 4 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative..
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .18 Submit 4 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .19 Delete information not applicable to project.
- .20 Supplement standard information to provide details applicable to project.
- .21 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .22 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

- .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 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 Not Used.

1.2 SECTION INCLUDES

- .1 Health and safety considerations required to ensure that PWGSC shows due diligence towards health and safety on construction sites, and meets the requirements laid out in PWGSC/RPB Departmental Policy DP 073 - Occupational Health and Safety - Construction.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .2 Province of British Columbia
 - .1 Workers Compensation Act, RSBC 1996 - Updated 2006.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 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 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

- .9 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 Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
 - .1 Facility Fire.

1.5 FILING OF NOTICE

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

1.6 SAFETY ASSESSMENT

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

1.7 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.8 REGULATORY REQUIREMENTS

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

1.9 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Steel and Iron
 - .2 Copper and Bronze
 - .3 Rotating Machinery
 - .4 Electrical Power
 - .5 Cold Water

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

1.11 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.

1.12 COMPLIANCE REQUIREMENTS

- .1 Comply with Workers Compensation Act, B.C.

1.13 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 Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.14 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with installation of pipe, rotating machinery, and electrical equipment.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of a Registered Occupational Hygienist or a Certified Industrial Hygienist and/or the site supervisor.

1.15 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 Province having jurisdiction, and in consultation with Departmental Representative.

1.16 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.17 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 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.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.
- .3 Comply with applicable local and national regulations for remediation and removal of hazardous materials.

1.3 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 Not Used.

1.2 REFERENCES

- .1 Not Used.

1.3 INSPECTION

- .1 Allow Departmental Representative 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 Departmental Representative 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 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. Departmental Representative shall pay cost of examination if work is found to be in accordance with Contract Documents.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.5 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.

1.6 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 DISCREPANCIES

- .1 If the Contractor, in the course of the Work, finds any discrepancies between Drawings and these Specifications or any errors or omissions in dimensions or instructions given by Drawings or Specifications, he shall immediately notify the Departmental Representative, in writing, and the Departmental Representative shall acknowledge receipt of the information in writing. Any work performed after such discovery, unless authorized by the Departmental Representative in writing, shall be at the Contractor's expense.

1.8 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.9 REPORTS

- .1 Submit 2 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.10 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.11 MILL TESTS

- .1 Submit mill test certificates as requested.

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 Not Used.
- 1.2 REFERENCES**
- .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA-S269.2-(Latest Version), Access Scaffolding for Construction Purposes.
- 1.3 SUBMITTALS**
- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4 INSTALLATION AND REMOVAL**
- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.
- 1.5 SCAFFOLDING**
- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.
- 1.6 HOISTING**
- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists and cranes to be operated by qualified operator.
- 1.7 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.

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work or Hatchery operations.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

1.9 SECURITY

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

1.10 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.

1.11 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.
- .3 Permanent facilities may be used on approval of Departmental Representative.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

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 Not Used.

1.2 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, Department Representative reserves right to have such products or systems tested to prove or disprove conformance.

1.3 QUALITY

- .1 SPEC NOTE: If a Supplementary Condition has been written on payment applications to delete the requirements of DOC 14 or 15, delete the following paragraph.
- .2 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.
- .3 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .4 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.
- .5 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .6 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .7 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.

1.4 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify

Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.5 **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 sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .5 Store and mix paints and adhesives in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .6 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .7 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.6 **TRANSPORTATION**

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

1.7 **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 Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.8 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.9 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.

1.10 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.11 REMEDIAL WORK

- .1 Refer to Section 01 73 00 - Execution.
- .2 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.
- .3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.12 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.13 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.

1.14 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.

1.15 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.16 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used.

1.2 SUBMITTALS

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

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

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

- .3 Include in request:

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

1.3 MATERIALS

- .1 Required for original installation.

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

1.4 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.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching 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 to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling. Dispose of waste material off site in compliance with local and national regulations.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used

1.2 REFERENCES

- .1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions "C", In Effect as Of: May 14, 2004.

1.3 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Departmental Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 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.
- .5 Dispose of waste materials and debris off site.
- .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.

1.4 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 including that caused by Departmental Representative or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .8 Remove dirt and other disfiguration from exterior surfaces.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling. Dispose of waste material off site in compliance with local and national regulations.

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 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work, conduct meeting with Departmental Representative to review Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environment damage.

1.2 RELATED SECTIONS

- .1 Not Used.

1.3 REFERENCES

- .1 LEED Canadian Green Building Council (CGBC), Green Building Rating System, For New Construction and Major Renovations LEED Canada-NC, Version 1.0.

1.4 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Inert Fill: inert waste - exclusively asphalt and concrete.
- .3 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .4 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .5 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .6 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .9 Separate Condition: refers to waste sorted into individual types.
- .10 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

- .11 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related required submittal and reporting requirements.

1.5 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Material Source Separation Plan.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of Materials Source Separation Program (MSSP) description.

1.7 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship materials to site operating under Certificate of Approval or premises of Departmental Representative.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.8 STORAGE, HANDLING AND PROTECTION

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

- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structures in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.9 DISPOSAL OF WASTES

- .1 Do not bury or burn rubbish and/or waste materials.
- .2 Do not dispose of waste volatile materials, mineral spirits, oil or paint thinner into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.10 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility.

1.11 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 SELECTIVE DEMOLITION

- .1 Reuse of Building Elements: this project has been designed to result in end of project rates for reuse of building elements as follows: do not demolish building elements beyond what is indicated on Drawings without approval by Departmental Representative's.
 - .1 Building Structure and Shell: 75 percent.
 - .2 Interior Non-Shell Elements: 50 percent.

3.2 APPLICATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.3 CLEANING

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

3.4 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged materials is not permitted.

3.5 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

- .1 Schedule E - Government Chief Responsibility for the Environment:

British Columbia	Ministry of Environment Lands and Parks 810 Blanshard Street, 4 th Floor Victoria BC V8V 1X4	604-387-1161	604-356-6464
	Waste Reduction Commission Soils and Hazardous Waste 770 South Pacific Blvd, Suite 303 Vancouver BC V6B 5E7	604-660-9550	604-660-9596

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 REFERENCES

- .1 Not Used.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative inspection.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
 - .4 Operation of systems: demonstrated to Departmental Representative's personnel.
 - .4 Submittals: All submittals have been received and approved in accordance with Section 01 33 00 Submittal Procedures and 01 78 00 Close Out Procedures.
 - .5 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative and Contractor
 - .2 If Work is incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.4 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: Separate waste materials for reuse and recycling and dispose of non-recyclable material off site in compliance with local and national regulations

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 Not Used.

1.2 ADMINISTRATIVE REQUIREMENTS

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in .dwg format on CD.

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Venders and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- .6 Training: refer to Section 01 79 10 – Equipment Startup, Testing and Training.

1.6 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.

- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of opaque drawings, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.8 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 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 co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Additional requirements: as specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.10 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.12 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include commissioned systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.

- .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.13 WARRANTY TAGS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Not Used.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.
- .2 Departmental Representative: provide list of personnel to receive instructions, and coordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with Sections 23 05 23.6 - Valves, 33 65 16 – Telethermics – Distribution Piping - PVC, 26 24 16 01 - Panelboards, and 26 28 23 - Disconnect Switches.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, alarms, servicing, and maintenance of each system component.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Section 23 05 23.06 – Valves: 4 hours of instruction
 - .2 Section 11 23 00 – Gas Balancing Columns: 4 hours of instruction
- .6 Time Allocated for Acceptance Testing
 - .1 The following acceptance test shall be conducted by the contractor and witnessed by a Departmental Representative prior to the Department taking ownership of the project.
 - .2 Hydrostatic testing of the new PVC piping shall be completed up to 150% of the rated pressure for the system. Up to 8 hours shall be allocated to complete hydrostatic testing.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.4 QUALITY ASSURANCE

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-(latest), Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A269-(latest), Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-(latest), Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .5 ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .6 OSHA 1910.27, Fixed Ladders.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-(latest), Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-(latest), Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-(latest), General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 CAN/CSA-G164-M92-(latest), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16.1-(latest), Limit States Design of Steel Structures.
 - .4 CSA W48-(latest), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .5 CSA W59-(latest), Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .4 The Environmental Choice Program
 - .1 CCD-047a-(latest), Paints, Surface Coatings.
 - .2 CCD-048-(latest), Surface Coatings - Recycled Water-borne.

1.2 SUBMITTALS

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

1.3 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.

1.4 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.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site container for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

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, galvanized finish.

- .3 New steel pipe for use in penstock and water conveyance to aeration tower: ASTM A53/A53M with fusion bonded epoxy to AWWA C-213.
- .4 Welding materials: to CSA W59.
- .5 Welding electrodes: to CSA W48 Series.
- .6 Bolts and anchor bolts: As noted on drawings.
- .7 Stainless steel tubing: to ASTM A269, Type 302 Commercial grade.
- .8 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.
- .9 Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.
- .10 Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.
- .11 Metal Bar Grating: As noted on drawings

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 flat 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 2 oz/ft² (600 g/m²) to CAN/CSA-G164.
- .2 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .3 Powder coated:
 - .1 Powder coat after fabrication to minimum 2.5 to 3.5 mil dry film thickness or as specified by powder coating manufacturer.
 - .2 Powder coating shall be fluoropolymer resin-based thermosetting powder meeting AAMA 2605-05 requirements.
 - .3 Surfaces to be powder coated shall be prepared as recommended by powder coating manufacturer.
 - .4 Powder coating applicator shall have a minimum of 10 years experience applying powder coatings.
 - .5 Ensure powder coating adheres to internal corners and recessed areas.
 - .6 Cure surfaces in accordance with manufacturers recommendations.

- .7 Product submittal procedures are as specified in Section 01 33 00. Also submit 2x3 inch sample panels of each finish color to be furnished for approval.
- .8 Finish coat to be smooth matte.
- .9 Powder coating colors shall be as selected by the Owner.
- .10 Colors to be furnished include one and two.
 - .1 Color one – Structural Members
 - .2 Color two – Bar Grating
- .11 Items to be powder coated include structural angles, channels, beams and bar grating.

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 Concrete, mortar and masonry.
 - .3 Wood.

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 45 °F (7°C).
- .3 Clean surfaces to be field welded; do not paint.

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 Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

- * .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 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

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Not Used

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.186-[1996], High Performance Glazed Coating System, Interior.
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-[04], Architectural Coatings.
- .5 American National Standards Institute (ANSI)
 - .1 Z53.1 - Safety Color Code for Marking Physical Hazards
- .6 American Society for Testing and Materials (ASTM)
 - .1 A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 A153 – Standard Specification for Zinc (Hot-Dip) on Iron and Steel Hardware
 - .3 A385 – Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip)

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .4 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for high build glazed coatings. Indicate VOC content.
- .6 Closeout Submittals:
 - .1 Provide maintenance data for coatings for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .1 Deliver and store materials in manner to prevent damage.
 - .2 Ensure materials remain in original wrapping and containers until used.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 SITE CONDITIONS

- .1 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
 - .2 Ensure no open flame heating devices are used.
 - .3 Discourage occupancy of treated space until volatile materials are no longer being emitted and there is no odour.
 - .4 Provide adequate respiratory protection to exposed individuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Component coatings shall be as described in Table 2.1.1.
- .2 Table 2.1.1 Coating Specifications

Component	Coating Specification
Misc. steel non-immersed	L-303
All system carbon steel pipe, hangers and pipe supports	L-303
Equipment support steel (interior & exterior.)	L-303
Misc. steel components that require on-site coatings application	HP-207
Misc. steel exposed to oils	HP-207
Misc. steel immersed, steel located in head tank	L-312
Stainless Steel	Shall not be coated.

- .3 Department Representative may substitute hot dip galvanizing for misc. steel and equipment support components.

2.2 MIXES

- .1 Mix coatings according to manufacturer's instructions.

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 datasheets.

3.2 PREPARATION

- .1 Prepare surfaces in accordance with CAN/CGSB-1.186 and coating material manufacturer's instructions.
- .2 Mask surrounding surfaces to provide neat, clean juncture lines.
- .3 Protect adjacent surfaces and equipment from damage by overspray.

3.3 APPLICATION

- .1 Preparation, installation, and application shall be in accordance with applicable Coatings Specifications.
- .2 Galvanizing coatings shall be applied in accordance with ASTM A123, ASTM A153, and ASTM A385.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 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.

COATING SPECIFICATION L-303

Date: 06-01-95 Revision: 0

SCOPE

This specification defines the method of surface preparation, materials application and inspection for coating carbon steel surfaces subject to normal interior and exterior exposed at operating temperatures not exceeding 150°F.

This system is not approved by the National Sanitation Foundation for use in potable water storage tanks. Not recommended for immersion in demineralized water.

Steel Structures Painting Council Specification, SSPC-PA-1-82 "No. 1 Shop, Field, and Maintenance Painting", shall govern minimum standards not covered by this specification.

COATING SYSTEM (NEW AND MAINTENANCE)

Surface Preparation:	DP-SP10	Near White Metal Blast Cleaning	
Prime Coat:	DP#72	High Build Epoxy	@ 5.0 DFT
Intermediate Coat:	DP#72	High Build Epoxy	@ 5.0 DFT
Finish Coat:	DP#72	High Build Epoxy	@ 5.0 DFT
		Minimum	15.0 DFT

APPROVED MATERIALS

PRODUCT NUMBER AND NAME	MANUFACTURER
DP#72 66 Series Hi-Build Epoxoline-Gray or White	Tnemec
DP#72 66 Series Hi-Build Epoxoline-Gray or White	Tnemec
DP#72 66 Series Hi-Build Epoxoline-Gray or White	Tnemec

* 20 Series Pota-Pox may be substituted for 66 Series when white, red or beige colors are used. Tnemec does not manufacture 20 Series in gray.

ATTACHMENTS

TITLE OF ATTACHMENT MANUAL SECTION

Product Data Sheet

DP#72

FM-17

COATINGS PRODUCT DATA SHEET

PAGE 1 OF 2

COMPANY:	Tnemec DP # 72	Date: 06-01-95	
PRODUCT NO:	20 or 66	REV: 0	
PRODUCT NAME:	Pota Pox or Hi-Build Epoxoline		
<p>PRODUCT DESCRIPTION: A high build catalyst epoxy formulated primarily for immersion service. 20 series (limited colors) is approved by the National Sanitation Foundation (NSF) and is only used in potable water tanks while 66 series is used in all other water immersion applications.</p>			
PRODUCT DATA			
VEHICLE TYPE:	Epoxy Resin		
PIGMENT TYPE:	Barium Sulfate, Titanium Dioxide		
COLOR:	Various		
GLOSS:	Medium		
SOLIDS BY VOLUME:	56%		
SOLIDS BY WEIGHT:	75%		
WEIGHT PER GALLON:	12.5 lbs.		
COVERAGE @ 1.0 MILS DFT:	898 sq. ft.		
VISCOSITY:	72 - 77 KU		
FLASH POINT:	82°F (Part A), 64 °F (Part B) SETA		
MSDS#:			
SHELF LIFE:	1 year		
STORAGE TEMPERATURE:	40°F - 100°F		
COMPONENTS:	Two		
MIXING RATIO:	1 to 1		
PHYSICAL PROPERTY INFORMATION			
NORMAL EXPOSURE:	Immersion		
FLEXIBILITY:	Good		
ABRASION RESISTANCE:	Very Good		
NORMAL DFT PER COAT	5.0 mils DFT		
TEMPERATURE LIMITS	INTERIOR	EXTERIOR	IMMERSION
CONSTANT	250 °F	250 °F	150 °F
INTERMITTENT:	275 °F	275 °F	150 °F
CHEMICAL RESISTANCE	FUME	SPLASH/SPILLAGE	IMMERSION
ACID	R	R	NR
ALKALI	R	R	NR
SALT	R	R	NR
SOLVENT	R	R	R
WATER	R	R	R
<p>R-Recommended LR-Limited Recommendations NR-Not Recommended NA-Not Applicable</p>			

COATINGS PRODUCT DATA SHEET

PAGE 2 OF 2

COMPANY:	Tnemec DP # 72				
PRODUCT NO:	20 or 66		Date:	06-01-95	
PRODUCT NAME:	Pota Pox or Hi-Build Epoxoline		REV:	0	
<p>MIXING: Mix individually Comp. A (base) and B (catalyst) thoroughly with power mixer. While mixing Comp. B, slowly add Comp. A and continue mixing until a smooth, uniform consistency is achieved. Allow mixed material to stand 30 minutes before application and re-stir before using.</p>					
APPLICATION DATA					
*APPLICATION CONDITIONS:					
Temperature:	Min. 55 °F				
	Max. 110 °F				
Relative Humidity:	Below: 90 °F				
*Dew Point shall not be within 5°F of surface/air temperature					
APPLICATION METHODS:	Spray, Brush (limited)				
THINNER & PERCENTAGE:	Brush	Tnemec #4	0 – 5%		
	Roller	NA			
	Spray	Tnemec #4	0 – 5% (airless), 0 – 10% (conv.)		
CLEAN UP THINNER:	Tnemec #4, MEK				
POT LIFE (+/-)	50°F	20 hrs.			
	70°F	12 hrs.			
	90°F	6 hrs.			
<u>DRYING TIME</u>	<u>TOUCH</u>	<u>HANDLE</u>	<u>HARD</u>	<u>RECOAT</u>	
(+/-)					
50°F	6 hrs.	18 hrs.	24 hrs.	24 hrs.	
70°F	2 hrs.	10 hr.	12 hrs.	12 hrs.	
90°F	1 hrs.	6 hrs.	10 hrs.	8 hrs.	
APPLICATION EQUIPMENT: (Recommendations Only)					
	<u>Conventional Spray</u>		<u>Airless Spray</u>		
Aircap:	78 - 704		Tip Orifice: .013 - .019		
Pot Pressure:	20 - 40		Filter Mesh: 60 - 80		
Fluid Tip/Needle:	D, E		Operating PSI: 1800 - 3200		
Atom Pressure:	50 - 80				
COMMENTS:					

COATING SPECIFICATION HP-207

Date: 06-01-95 Revision: 11-27-00 (Rev. 2)

SCOPE

This specification defines the method of surface preparation, materials application and inspection for coating carbon steel surfaces where a commercial blast is not possible and/or practical and only minimum surface preparation is achieved for surfaces subject to normal interior and exterior exposures at operating temperatures not exceeding 200°F (93 °C).

Steel Structures Painting Council Specification, SSPC-PA-1-82 “No. 1 Shop, Field, and Maintenance Painting”, shall govern minimum standards not covered by this specification.

COATING SPECIFICATION (NEW AND MAINTENANCE)

Surface Preparation:	DP-SP6	Commercial Blast Cleaning (New)
	DP-SP28	Maintenance
Prime/Finish Coat:	DP#93	Epoxy Mastic @ 5.0 to 7.0 DFT

APPROVED MATERIALS

PRODUCT NUMBER AND NAME	MANUFACTURER
DP#93 Amerlock 400 or 400FD	Ameron

NOTE: No coating material substitutions without Department Representative’s approval.

ATTACHMENTS	TITLE OF ATTACHMENT	MANUAL SECTION
Product Data Sheet	DP#93	FM-17

COATINGS PRODUCT DATA SHEET

PAGE 1 OF 2

COMPANY: Ameron DP # 93 PRODUCT NO: 400 Date: 03-01-95 PRODUCT NAME: Amerlock 400 REV: 0			
PRODUCT DESCRIPTION: A two-component epoxy mastic formulated with good wetting properties and high build characteristics that can be applied in a single coat application over marginally clean surfaces when blasting is not practical or possible.			
PRODUCT DATA			
VEHICLE TYPE:	Epoxy Resin, Polyamide Resin		
PIGMENT TYPE:	Titanium Dioxide		
COLOR:	Various		
GLOSS:	Semi-Gloss		
SOLIDS BY VOLUME:	83%		
SOLIDS BY WEIGHT:	87%		
WEIGHT PER GALLON:	12.2 lbs.		
COVERAGE @ 1.0 MILS DFT:	1331 sq. ft.		
VISCOSITY:	4000 – 8000 CPS		
FLASH POINT:	85°F PMCC		
MSDS#:	11893 (Catalyst), Base – Depends on color		
SHELF LIFE:	1 year		
STORAGE TEMPERATURE:	40°F - 100°F		
COMPONENTS:	Two		
MIXING RATIO:	1 Part – Base to 1 Part Catalyst		
PHYSICAL PROPERTY INFORMATION			
NORMAL EXPOSURE:	Exterior (chalks) and Interior		
FLEXIBILITY:	Good		
ABRASION RESISTANCE:	Good		
NORMAL DFT PER COAT	5.0 mils DFT		
TEMPERATURE LIMITS	INTERIOR	EXTERIOR	IMMERSION
CO CONSTANT	200 °F	200 °F	NA
INTERMITTENT:	350 °F	350 °F	NA
CHEMICAL RESISTANCE	FUME	SPLASH/SPILLAGE	IMMERSION
ACID	R	LR	NR
ALKALI	R	R	NR
SALT	R	R	NR
SOLVENT	R	R	NR
WATER	R	R	NR
R-Recommended	LR-Limited Recommendations	NR-Not Recommended	NA-Not Applicable

COATINGS PRODUCT DATA SHEET

PAGE 2 OF 2

COMPANY:	Ameron DP # 93	Date: 03-01-95
PRODUCT NO:	400	400 REV: 0
PRODUCT NAME:	Amerlock	

MIXING: Mix separately base and catalyst. Add catalyst to base and mix thoroughly with a power mixer until a uniform consistency is achieved.

APPLICATION DATA

*APPLICATION CONDITIONS:

Temperature: Min. 50 °F
Max. 100 °F
Relative Humidity: Below: 90 °F

*Dew Point shall not be within 5°F of surface/air temperature

APPLICATION METHODS: Brush, Roller, Airless and Conventional Spray

THINNER & PERCENTAGE: Brush None
Roller None
*Spray #65 0 – 3 % Airless 0 – 5 % Conventional

* #8 thinner may be substituted for #65 thinner when temperature is above 85 °F.

CLEAN UP THINNER: #65, R7K54, Xylol

POT LIFE (+/-) 50°F 4 hrs.
70°F 2 ½ hrs.
90°F 1 ½ hrs.

DRYING TIME (+/-)	<u>TOUCH</u>	<u>HANDLE</u>	<u>HARD</u>	<u>RECOAT</u>
50°F	28 hrs.	72 hrs.	72 hrs.	48 hrs.
70°F	9 hrs.	24 hr.	20 hrs.	16 hrs.
90°F	4 ½ hrs.	12 hrs.	12 hrs.	12 hrs.

APPLICATION EQUIPMENT: (Recommendations Only)

Conventional Spray

Aircap: 64, 78 - 704
Pot Pressure: 30 - 60
Fluid Tip/Needle: D, E
Atom Pressure: 60 - 80

Airless Spray

Tip Orifice: .035 - .038
Filter Mesh: 30 - 60
Operating PSI: 2200 - 3200

COMMENTS:

- Thin cautiously because excessive thinning will cause sagging and runs.
- When applying over conventional coatings, a test patch should be applied to ensure softening and lifting of the existing coating does not occur.

COATING SPECIFICATION L-312

Date: 06-01-95 Revision: 0

SCOPE

This specification defines the method of surface preparation, materials application and inspection for coating carbon steel surfaces subject to immersion exposure in water.

Steel Structures Painting Council Specification, SSPC-PA-1-82 "No. 1 Shop, Field, and Maintenance Painting", shall govern minimum standards not covered by this specification.

COATING SYSTEM (NEW AND MAINTENANCE)

Surface Preparation:	DP-SP10	Near White Metal Blast Cleaning	
Prime Coat:	DP#72	High Build Epoxy	@ 5.0 DFT
Intermediate Coat:	DP#72	High Build Epoxy	@ 5.0 DFT
Finish Coat:	DP#72	High Build Epoxy	@ 5.0 DFT
		Minimum	15.0 DFT

APPROVED MATERIALS

PRODUCT NUMBER AND NAME	MANUFACTURER
DP#72 20-AA90 Pota-Pox-White	Tnemec
DP#72 20-1211 Pota-Pox-Red or 20-1255 Pota-Pox-Beige	Tnemec
DP#72 20-AA90 Pota-Pox-White	Tnemec

NOTE: No coating material substitutions without Department Representative's approval.

END OF SECTION

Part 1

1.1 RELATED SECTIONS

- .1 Not Used.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Dimensional Drawings:
 - .1 Fabrication drawings for aeration columns shall include:
 - .1 Overall out side dimensions
 - .2 Cover plate, vent stacks, and distribution plate details
 - .3 Dispersion plates, mounting tabs, center distribution pipe details
 - .4 Exploded view showing minimum space requirements for maintenance

1.3 CLOSEOUT SUBMITTALS

- .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

Part 2 Products

2.1 AERATION COLUMNS

- .1 All aeration columns shall be provided by a single manufacturer. The manufacturer shall be a recognized manufacturer of aeration columns specifically for aquaculture and have at least 5 years experience specific to the design and manufacture of aeration columns. A list of 4 installation references similar to these specifications shall be supplied along with other submittal materials.
- .2 Aeration columns shall be of the size and configuration shown on the Drawings.
- .3 Aeration columns shall have a minimum of 6 internal dispersion plates, not include the top distribution plate. The dispersion plates shall have a minimum of 40% open area and opening no smaller than 25-MM in diameter.
- .4 Aeration columns must be able to operate with efficient water distribution and resist phase inversion at loading variances between 800 and 3600 LPM per square meter. Use of a secondary distribution plate which rests upon the main distribution plate is acceptable at lower loading rates. Design flow rate for 1070mm diameter aeration

columns is 2900 LPM. Design flow rate for 915mm diameter aeration columns is 2000 LPM. Design flow rate for the 760mm diameter aeration columns is 1860 LPM.

- .5 The aeration columns shall be constructed of FRP, and the distribution plates and covers shall be constructed of stainless steel type 304.
- .6 Top Distribution plate assembly shall have chimney vents with a total height as required to prevent water flow into the chimneys. The distribution plate and vents shall be designed by the manufacturer to meet flow requirements noted in 2.1.4 above.
- .7 The Aeration Column top cover plate shall be held in place by swing bolts. Size and quantity of swing bolt shall be determined by column manufacturer.
- .8 Aeration columns shall be designed to allow maintenance with Aeration Columns in place.

Part 3 Execution

3.1 PREPARATION

- .1 Aeration column and mounting plate preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that aeration can sets level on mounting plate and pipe grooves are free of dirt or surface irregularities which may disrupt coupling seating and cause external leakage.
 - .3 Inspect internal tabs and dispersion plate seating and verify that the dispersion plates sit firmly in place.
 - .4 Inspect fit-up between internal distribution pipe and dispersion plates. Internal pipe should fit snug within dispersion plates preventing vibration.

3.2 INSTALLATION OF AERATION COLUMNS

- .1 Coordinate with the Departmental Representative and Hatchery Manager.
- .2 Submit a detailed installation schedule, including which aeration columns will need to be out of commission and the duration of time they will be inoperable.
- .3 Install in accordance with manufacturer's instructions.
- .4 Use gaskets between aeration column flanges and mounting plate unless instructed otherwise by column manufacturer.
- .5 Handle aeration column with care so as to prevent damage to external shell, mounting flange, and dispersion plates.
- .6 Ensure that aeration columns are centered plate openings and before bolts are tightened and then opened and closed column isolation valve to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and components for metering water flow including installation.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME Fluid Meter's Handbook: Their Theory and Application, Sixth Edition

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

- .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL 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.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.3 Submittals to include:

- .1 Piping configuration and sizing - straight pipe upstream and downstream, and distances to first fittings.
- .2 Service conditions.
- .3 Full details of primary element - standard of design and construction, materials, type serial number, flow rate, differential pressure, irrecoverable head loss (IHL), calculation sheets.
- .4 Accuracy statements for each component at specified flow rates and other conditions.
- .5 Flow and temperature ranges.
- .6 Signal processor calibration data.
- .7 Minimum turndown ratio.

.4 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.

- .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
 - .1 Submit maintenance data including monitoring requirements for incorporation into manuals 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 29.06 - 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 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 Process Water Supply

- .1 Type of metering:
 - .1 Flow Metering
- .2 Flow Meters FA-FM, SH-FM, WA-FM, & WH-FM
 - .1 FA-FM shall be sized for 250mm PVC flanged pipe and have a flow range of 0 to 6,250LPM with a cut off flow of 32LPM.
 - .1 Material of Construction:

.1	Body	Welded Steel, Epoxy Coated
.2	Electrodes	316 Stainless Steel
.3	Liner	Polypropylene
.4	Housing	Ductile cast iron, powder coated
.5	Flanges	150 lb. ANSI Pattern
.6	O rings	EPDM
 - .2 Temperature Rating: -12°C to 54°C
 - .3 Display:
 - .1 Type 128x64 dot matrix LCD
 - .2 Digits 5 Digit Rate
 - .4 Accuracy: +/- 1% of reading across rated range

- .5 Power: 120v AC Power
- .6 Output Signal: 4-20mA
- .7 Cable: Remote Display cable length 20m. Confirm actual field measurement after remote display indicator location is known.
- .2 SH-FM shall be sized for 250mm PVC flanged pipe and have a flow range of 0 to 5,700LPM with a cut off flow of 30LPM.
 - .1 Material of Construction:
 - .1 Body Welded Steel, Epoxy Coated
 - .2 Electrodes 316 Stainless Steel
 - .3 Liner Polypropylene
 - .4 Housing Ductile cast iron, powder coated
 - .5 Flanges 150 lb. ANSI Pattern
 - .6 O rings EPDM
 - .2 Temperature Rating: -12°C to 54°C
 - .3 Display:
 - .1 Type 128x64 dot matrix LCD
 - .2 Digits 5 Digit Rate
 - .4 Accuracy: +/- 1% of reading across rated range
 - .5 Power: 120v AC Power
 - .6 Output Signal: 4-20mA
 - .7 Cable: Remote Display cable (9m) standard length
- .3 WA-FM shall be sized for 150mm PVC flanged pipe and have a flow range of 0 to 2,000LPM with a cut off flow of 10LPM.
 - .1 Material of Construction:
 - .1 Body Welded Steel, Epoxy Coated
 - .2 Electrodes 316 Stainless Steel
 - .3 Liner Polypropylene
 - .4 Housing Ductile cast iron, powder coated
 - .5 Flanges 150 lb. ANSI Pattern
 - .6 O rings EPDM
 - .2 Temperature Rating: -12°C to 54°C
 - .3 Display:
 - .1 Type 128x64 dot matrix LCD
 - .2 Digits 5 Digit Rate
 - .4 Accuracy: +/- 1% of reading across rated range
 - .5 Power: 120v AC Power
 - .6 Output Signal: 4-20mA
 - .7 Cable: Remote Display cable (9m) standard length
- .4 WH-FM shall be sized for 200mm PVC flanged pipe and have a flow range of 0 to 3,725LPM with a cut off flow of 20LPM.
 - .1 Material of Construction:

- .1 Body Welded Steel, Epoxy Coated
- .2 Electrodes 316 Stainless Steel
- .3 Liner Polypropylene
- .4 Housing Ductile cast iron, powder coated
- .5 Flanges 150 lb. ANSI Pattern
- .6 O rings EPDM
- .2 Temperature Rating: -12°C to 54°C
- .3 Display:
 - .1 Type 128x64 dot matrix LCD
 - .2 Digits 5 Digit Rate
- .4 Accuracy: +/- 1% of reading across rated range
- .5 Power: 120v AC Power
- .6 Output Signal: 4-20mA
- .7 Cable: Remote Display cable (9m) standard length
- .5 Flow meters shall be Seametrics iMAG-Series flanged magmeter or approved equivalent.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION OF PRIMARY ELEMENT

- .1 Follow manufacturer's instructions.
- .2 Straight Pipe Recommendations:
 - .1 2x Pipe Diameter upstream of the meter and 1x Pipe Diameter downstream of the meter.
 - .2 Follow manufacturer's minimum guidelines.
- .3 Grounding requirements:
 - a) Nonmetallic or lined pipe:
 - .1 Inlet and outlet grounding rings of same material as electrode.

3.3 INSTALLATION OF TRANSMITTERS

- .1 Mount on wall or pipe stand, install, and located to ensure no damage by passing traffic.
- .2 Provide excitation and signal cables between magnetic flowmeter and transmitter, per manufacturer's instructions. If manufacturer's instructions are non specific, See detail 3/E1.
- .3 Provide analog cable (twisted shielded pair #18 AWG) to future PLC location. Ground shield at powered end only, see detail 2/E1.

- .4 Provide 120 volt AC power. See Electrical sheets.

3.4 INSTALLATION OF SIGNAL TRANSMISSION CABLE

- .1 Ground shielding at one point only.
- .2 Protect against RF interference.
- .3 Cross electrical cables, conduits at 90 degrees leaving at least 150 mm space between.

3.5 START-UP

- .1 Follow manufacturer's recommendations.

3.6 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 RELATED REQUIREMENTS

- .1 Not Used.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
- .2 Standards of American Water Works Associations, AWWA.
 - .1 C504, Standard for Rubber-Seated Butterfly Valves.
 - .2 C509, Resilient-Seated Gate Valves for Water-Supply Service
 - .3 C542, Standard for Electric Motor Actuators for Valves and Slide Gates.
- .3 Standards of National Electrical Manufacturer's Association, NEMA.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets for valves and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Dimensional Drawings:
 - .1 General Arrangement of all Valves
 - .2 Shop drawings shall indicate all material types, sizes and dimensions required for a complete and functional installation. Fastener material, sizes and quantities shall be included with the submittal for gates.
 - .1 Shop drawings shall indicate any preparation required before gate installation. This preparation shall include, but not be limited to, blockouts, embeds, predrilled holes, and mounting hardware attachment.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

1.6 MAINTENANCE MATERIAL SUBMITTALS -NOT USED

Part 2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 150 PSIG (1035 KPA)

- .1 To be of single manufacturer.
- .2 To be suitable for dead-end service.
- .3 CRN registration number required for products.
- .4 Sizes:
 - .1 Lug type: NPS 2 to 30.
- .5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.
 - .1 NPS 2 - 24: 150 psig (1035 kPa)
- .6 Minimum seat temperature ratings to 250° F (121° C).
- .7 Full lug body (threaded).
- .8 Operators:
 - .1 Manual enclosed gear operators where shown on the drawings.
 - .1 Counter clockwise opening as viewed from the top.
 - .2 Manual actuators shall utilize the traveling nut design per AWWA C504.
 - .3 Manual actuators shall utilize external adjustable closed position stops capable of withstanding 450 ft-lb.
 - .4 Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
 - .5 Size manual actuators to produce required torque with a maximum pull of 80 pounds force at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 lbf (890 N) on the handwheel or chainwheel or 300 ft-lbs (405 Nm) torque on the operating nut.
 - .6 NPS 2 - 6: handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees unless indicated otherwise on the drawings. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black lacquer.
 - .2 Electric actuators where shown on the drawings.
 - .1 Equipment Requirements
 - .1 Where electric motor actuators are indicated, attach an electric motor-actuated control unit to the actuating mechanism housing by means of a flanged motor adapter piece.
 - .2 Gearing
 - .1 Provide the motor actuator with the motor, reduction gearing, reversing starter, torque switches, and limit switches in a weather-proof assembly NEMA rated for the mounting location.
 - .2 Provide a single- or double-reduction unit, consisting of spur or helical gears and worm gearing.

- .3 Construct the spur or helical gears of hardened alloy steel, and the worm gear of alloy bronze.
 - .4 Accurately cut gearing with hobbing machines.
 - .5 Power gearing shall be grease- or oil-lubricated in a sealed housing.
 - .6 Use ball or roller bearings throughout.
 - .7 Actuator output speed changes shall be mechanically possible by simply removing the motor and changing the exposed or helical gearset ratio without further disassembly of the actuator.
- .3 Starting Device
- .1 Design the unit such that a hammer blow is imparted to the stem nut when opening a closed valve or gate, or closing an open valve or gate.
 - .2 The device shall allow free movement at the stem nut before imparting the hammer blow.
 - .3 The actuator motor shall attain full speed before the stem load is encountered.
- .4 Switches of either the mechanical or electronic type shall be provided integral to the actuator. Switches shall be factory installed and calibrated.
- .1 Mechanical Type Switches
- .1 Provide limit switches of the gear open-type, actuated by a cam with 4contacts to each cam or gear train.
 - .2 The torque switch shall be activated by a mechanical torque, developed in the seating of valve or gate, or by an obstruction met in the opening and closing of the valve or gate.
 - .3 Provide an adjustable torque setting, functioning without the use of auxiliary devices or relays.
 - .4 Provide position limit switches and associated gearing as an integral part of the actuator.
 - .5 In order to provide the best possible accuracy and repeatability, provide limit switch gearing of the "counting" intermittent type, constructed of stainless steel, grease-lubricated, and enclosed in its own gear case in order to prevent dirt and foreign matter from entering the gear train.
 - .6 Provide valve and gate actuators with mechanical type switches as manufactured by EIM or equal.
- .5 Electronic-Type Switches
- .1 Limit switches or valve or gate position shall be sensed by a 15-bit, optical, absolute position encoder.
 - .2 The open and closed positions shall be stored in a permanent, non-volatile memory.
 - .3 The encoder shall measure valve or gate position continuously, including both motor and hand wheel operation, with or without use of battery.
 - .4 Provide an electronic torque sensor.

- .5 Provide an adjustable torque limit, from 40 to 100 percent of rating in one-percent increments.
- .6 The motor shall be de-energized if the torque limit is exceeded.
- .7 Provide a boost function in order to prevent torque-trip during initial valve or gate unseating, and a "jammed valve" protection feature with automatic retry sequence in order to de-energize the motor if no movement occurs.
- .6 The actuator shall be wired in accordance with the schematic diagram.
- .7 Connect wiring for external connections to marked terminals.
- .8 Provide one 1-inch and one 1-1/4 inch conduit connection in the enclosing case.
- .9 Mount a calibration tag near each switch, correlating the dial setting to the unit output torque.
- .10 Switches shall not be subject to breakage or slippages due to over-travel.
- .11 Do not use traveling-nuts, cams, or micro-switch tripping mechanisms.
- .12 Provide limit switches of the heavy-duty, open contact type, with rotary wiping action.
- .3 Hand-wheel Operation
 - .1 Provide a permanently attached hand-wheel for emergency manual operation.
 - .2 The hand-wheel shall not rotate during electrical operation.
 - .3 The maximum torque required on the handwheel under the most adverse conditions shall not exceed 60 lb-ft, and the maximum force required on the rim of the handwheel shall not exceed 60 lb.
 - .4 Cast or permanently affix an arrow and either the word "OPEN" or "CLOSE" on the handwheel in order to indicate the appropriate direction to turn the handwheel.
 - .5 Provide a clutch lever to put the actuator into handwheel operation.
 - .6 Provide chain activator handwheels for valves or gates with electric motor actuators having stems more than 6 feet above the floor.
 - .7 Provide the clutch lever with a cable secured to the chain in order to allow disengagement for manual operation.
- .4 Motor
 - .1 Provide a motor of the totally enclosed, non-ventilated, high-starting torque, lowstarting current type, for full-voltage starting.
 - .2 The motor shall be suitable for operation on 120 volt, 1 phase 60 Hz current, with Class F insulation and a motor frame with dimensions in accordance with the latest revised NEMA MG Standards.
 - .3 The observed temperature rise by thermometer shall not exceed 55 degrees C above an ambient temperature of 40 degrees C, when operating continuously for 15 minutes under full-rated load.
 - .4 With a line voltage ranging between 10 percent above to 10 percent below the rated voltage, the motor shall develop full-rated torque continuously for 15 minutes without causing the thermal contact protective devices imbedded in the motor windings to trip or the starter overloads to drop out.

- .5 Provide bearings of the ball type, and provide thrust bearings where necessary.
 - .6 Provide the bearings with suitable seals in order to confine the lubricant and to prevent the entrance of dirt and dust.
 - .7 Provide watertight motor conduit connections.
 - .8 Motor construction shall incorporate the use of stator and rotor as independent components from the valve or gate operation such that the failure of either item shall not require actuator disassembly or gearing replacement.
 - .9 Provide two Class B thermal contacts or solid-state thermistors embedded within the motor windings in order to protect against over-temperature damage.
 - .10 Provide the motor with a space heater suitable for operation on a 120-volt, single-phase, 60-Hz circuit, unless the entire actuator is of a hermetically sealed, non-breathing design with a separately sealed terminal compartment which prevents moisture intrusion.
 - .11 Provide each electric motor actuator with a local disconnect switch or circuit breaker in order to isolate power from the motor and controller during maintenance activities.
- .9 Valves shall be compatible with ANSI Class 150 flanges.
- .10 Valve construction:
- .1 Body
 - .1 Material: PVC Type I Cell Classification 12454 or CPVC Type IV Cell Classification 23447ASTM.
 - .2 Design: Wafer type with fully tapped and threaded stainless steel anchor lugs per ASME B16.5.
 - .2 Disc:
 - .1 Material: PVC Type I Cell Classification 12454 or CPVC Type IV Cell Classification 23447ASTM.
 - .3 Seat
 - .1 Material: Ethylene Propylene Diene Monomer (EPDM) or Department approved alternate.
 - .2 Design: Resilient seat complying with AWWA C504.
 - .4 Mating surfaces Material: ASTM A276, 18-8, Type 304, stainless steel.
 - .5 Shaft Material: ASTM A276, 18-8, Type 304 stainless steel.
 - .6 Taper pin Material: ASTM A276, 18-8, Type 304 stainless steel.
 - .7 Key Material: Carbon steel.
 - .8 O-Ring Material: EPDM.
 - .9 Bushing Material: Luberized bronze.

2.2 Ball Valves

- .1 Ball Valves - Plastic Body
 - .1 Ball valves shall be lever handled true union rated at 150 psi, non-shock. Valves shall be thermoplastic PVC materials with self lubricating Teflon seats, EPDM O-rings, full-port design. Valves shall be "safe blocked" such that downstream end can be disassembled while upstream remains pressurized.

- .2 Valves shall have true union connections
- .3 Valves shall have two valve configurations as shown on the drawings.
- .4 Termination ball valves may be single union.

2.3 Air Release Valves

- .1 Air Release Valve
 - .1 Air release valves shall be of the simple lever type and shall be capable of automatically releasing accumulated air from a fluid system while that system is in operation and under pressure.
 - .2 To assure drip tight shut-off, a viton orifice button shall be used to seal the valve discharge orifice when the valve is in a closed position.
 - .3 Unless otherwise indicated on the Drawings, the inlet size shall be 19mm and the orifice diameter shall be 5.6mm.
 - .4 The body and cover shall be of cast iron. With the exception of the viton orifice button, the leverage mechanism, float and all other internal trim shall be of stainless steel.
 - .5 The stainless steel float shall be designed to and capable of withstanding a pressure in excess of 1000 psi.

2.4 Water Control Gates – Downward Acting Weir Slide Gates

- .1 All water control gates shall be manufacturer's standard design unless otherwise specified and shall be furnished with electric actuators shown on the Drawings. Unless otherwise indicated, the direction of rotation of the wheel, wrench nut or lever to open the gate shall be to the left (counter-clockwise). Each gate body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.
- .2 All water control gates of the same type shall be from a single manufacturer.
- .3 Unless otherwise specifically noted in these specifications or on the drawings, all gates in contact with water shall have only stainless steel, Buna N or plastic for bodies and trim. No bronze trim or seats will be allowed.
- .4 All water control gates shall be complete, including all gates, guides, frames, bench studs, base plates, brackets, anchor bolts, stems, stem extensions, stem guides, manual operators, and all other necessary appurtenances.
- .5 Maximum manual effort required to operate any gate, after the gate has unseated, shall not exceed 40 pounds.
- .6 The use of a manufacturer's name and catalog number is for the purpose of establishing a standard of quality and general configuration desired only.
- .7 All necessary attaching bolts, anchor bolts, mounting and assembly hardware shall of Type 316 stainless steel, and shall be furnished by the gate manufacturer.

.1 Guide Frames

- .1 Guide frames shall be stainless steel, incorporating a dual slot design. The vertical guides shall be designed for maximum rigidity, and shall extend in one continuous piece from the gate. Guides shall incorporate a replaceable extruded dense polyethylene bearing strip in an extruded retainer slot on the downstream side of the gate.

- .2 The frame invert shall be stainless steel. Provide a neoprene insert that functions as a seating surface for the gate cover.
 - .3 Vertical guide frames and invert shall be joined with factory welded corners. The yoke supporting the operating device shall be formed by members welded or bolted at the top of the guides. Where guides extend above the operating floor, the guides and yoke shall be sufficiently strong so that no further reinforcing will be required.
 - .4 Guide slots shall be sized to provide a minimum cover engagement of 25mm on each side.
- .2 Cover (Sliding Member)
- .1 The cover plate shall be one-piece stainless steel plate, reinforced as required so that the cover will not deflect more than 1/360 of the gate span, when the upstream liquid depth is as specified and the downstream liquid depth is less than 1/2 inch. Gate cover shall be reinforced with one-piece stainless steel angles or channel type extrusions welded to the cover plate. The pocket and yoke of the gate shall be sufficiently strong to withstand a load of 100 pounds applied at the operator. Bolted reinforcements will not be permitted.
- .3 Stems
- .1 Lifting stems shall be one-piece Type 303, Type 304, or Type 316 stainless steel, with a minimum diameter of 1 inch, and of ample cross-section to prevent distortion.
 - .2
 - .3 Stems shall be sized so that the ratio of the unsupported stem length (L) to the radius of gyration (r), both in similar units does not exceed 200.
 - .4 Stems shall be designed to withstand in compression, without damage, the thrust equal to at least 2-1/2 times the rated output of the housing mechanism, with a 40 pound effort applied to the handwheel or crank.
 - .5 The stems shall be connected to the cover plate by means of a stainless steel yoke, bolted to the stem and welded to the cover.
- .4 Electric Gate Operators
- .1 Equipment Requirements
 - .1 Where electric motor actuators are indicated, attach an electric motor-actuated control unit to the actuating mechanism housing by means of a flanged motor adapter piece.
 - .2 2. Gearing
 - .1 Provide the motor actuator with the motor, reduction gearing, reversing starter, torque switches, and limit switches in a weather-proof assembly NEMA rated for the mounting location.
 - .2 Provide a single- or double-reduction unit, consisting of spur or helical gears and worm gearing.
 - .3 Construct the spur or helical gears of hardened alloy steel, and the worm gear of alloy bronze.
 - .4 Accurately cut gearing with hobbing machines.

- .5 Power gearing shall be grease- or oil-lubricated in a sealed housing.
- .6 Use ball or roller bearings throughout.
- .7 Actuator output speed changes shall be mechanically possible by simply removing the motor and changing the exposed or helical gearset ratio without further disassembly of the actuator.
- .3 Switches of either the mechanical or electronic type shall be provided integral to the actuator. Switches shall be factory installed and calibrated.
 - .1 Mechanical Type Switches
 - .1 Provide limit switches of the gear open-type, actuated by a cam with 4contacts to each cam or gear train.
 - .2 The torque switch shall be activated by a mechanical torque, developed in the seating of valve or gate, or by an obstruction met in the opening and closing of the valve or gate.
 - .3 Provide an adjustable torque setting, functioning without the use of auxiliary devices or relays.
 - .4 Provide position limit switches and associated gearing as an integral part of the actuator.
 - .5 In order to provide the best possible accuracy and repeatability, provide limit switch gearing of the "counting" intermittent type, constructed of stainless steel, grease-lubricated, and enclosed in its own gear case in order to prevent dirt and foreign matter from entering the gear train.
 - .6 Provide valve and gate actuators with mechanical type switches as manufactured by EIM or equal.
 - .4 Electronic-Type Switches
 - .1 Limit switches or valve or gate position shall be sensed by a 15-bit, optical, absolute position encoder.
 - .2 The open and closed positions shall be stored in a permanent, non-volatile memory.
 - .3 The encoder shall measure valve or gate position continuously, including both motor and hand wheel operation, with or without use of battery.
 - .4 Provide an electronic torque sensor.
 - .5 Provide an adjustable torque limit, from 40 to 100 percent of rating in one-percent increments.
 - .6 The motor shall be de-energized if the torque limit is exceeded.
 - .7 Provide a boost function in order to prevent torque-trip during initial valve or gate unseating, and a "jammed valve" protection feature with automatic retry sequence in order to de-energize the motor if no movement occurs.
 - .5 The actuator shall be wired in accordance with the schematic diagram.
 - .6 Connect wiring for external connections to marked terminals.
 - .7 Provide one 25mm and one 38mm conduit connection in the enclosing case.

- .8 Mount a calibration tag near each switch, correlating the dial setting to the unit output torque.
- .9 Switches shall not be subject to breakage or slippages due to over-travel.
- .10 Do not use traveling-nuts, cams, or micro-switch tripping mechanisms.
- .11 Provide limit switches of the heavy-duty, open contact type, with rotary wiping action.
- .5 Hand-wheel Operation
 - .1 Provide a permanently attached hand-wheel for emergency manual operation.
 - .2 The hand-wheel shall not rotate during electrical operation.
 - .3 The maximum torque required on the handwheel under the most adverse conditions shall not exceed 60 lb-ft, and the maximum force required on the rim of the handwheel shall not exceed 60 lb.
 - .4 Cast or permanently affix an arrow and either the word "OPEN" or "CLOSE" on the handwheel in order to indicate the appropriate direction to turn the handwheel.
 - .5 Provide a clutch lever to put the actuator into handwheel operation.
 - .6 Provide chain activator handwheels for valves or gates with electric motor actuators having stems more than 6 feet above the floor.
 - .7 Provide the clutch lever with a cable secured to the chain in order to allow disengagement for manual operation.
- .6 Motor
 - .1 Provide a motor of the totally enclosed, non-ventilated, high-starting torque, lowstarting current type, for full-voltage starting.
 - .2 The motor shall be suitable for operation on 208 volt, 3 phase 60 Hz current, with Class F insulation and a motor frame with dimensions in accordance with the latest revised NEMA MG Standards.
 - .3 The observed temperature rise by thermometer shall not exceed 55 degrees C above an ambient temperature of 40 degrees C, when operating continuously for 15 minutes under full-rated load.
 - .4 With a line voltage ranging between 10 percent above to 10 percent below the rated voltage, the motor shall develop full-rated torque continuously for 15 minutes without causing the thermal contact protective devices imbedded in the motor windings to trip or the starter overloads to drop out.
 - .5 Provide bearings of the ball type, and provide thrust bearings where necessary.
 - .6 Provide the bearings with suitable seals in order to confine the lubricant and to prevent the entrance of dirt and dust.
 - .7 Provide watertight motor conduit connections.
 - .8 Motor construction shall incorporate the use of stator and rotor as independent components from the valve or gate operation such that the failure of either item shall not require actuator disassembly or gearing replacement.
 - .9 Provide two Class B thermal contacts or solid-state thermistors embedded within the motor windings in order to protect against over-temperature damage.

- .10 Provide the motor with a space heater suitable for operation on a 120-volt, single-phase, 60-Hz circuit, unless the entire actuator is of a hermetically sealed, non-breathing design with a separately sealed terminal compartment which prevents moisture intrusion.
- .11 Provide each electric motor actuator with a local disconnect switch or circuit breaker in order to isolate power from the motor and controller during maintenance activities.

Part 3 Execution

3.1 PREPARATION

- .1 Valve and mating flange preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
- .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .3 Verify suitability of valve for application by inspection of identification tag.
- .4 Handle valve with care so as to prevent damage to disc and seat faces.
- .5 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .6 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

- .1 Cycle valve operation from fully closed to fully open then back to fully closed.
- .2 At same time, check travel stop settings for proper disc alignment.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, and equipment.
- .2 Related Sections:
 - .1 Not Used

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-(Latest), Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A125-(Latest), Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-(Latest), Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-(Latest), Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-(Latest), Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69-(Latest), Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-(Latest), Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)
- .7 National Building Code of Canada (NBC) – (Latest)

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
- .3 Submit shop drawings and product data for following items:

- .1 Bases, hangers and supports.
- .2 Connections to equipment and structure.
- .3 Structural assemblies.
- .4 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.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide 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 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling. Dispose of no-recyclable materials off site in compliance with local and national regulations.

Part 2 Products

2.1 GENERAL

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 and ASME B31.1.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, and hangers to withstand seismic events as specified NBC.
 - .3 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
 - .4 Use components for intended design purpose only.

2.2 PIPE HANGERS- NOT USED

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, FM approved.
- .2 Bolts: to ASTM A307.
- .3 Nuts: to ASTM A563.

2.4 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.5 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.
- .3 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .5 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .6 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING- NOT USED

3.4 HANGER INSTALLATION-NOT USED

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3, Identification of Piping Systems.

1.3 SUBMITTALS

- .1 Product Data:
- .2 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.4 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling. Dispose of non-reused and non-recycled items off site in accordance with local and national regulations.

- .2 Dispose of unused paint or coating material at official hazardous material collection site approved by Departmental Representative.
- .3 Do not dispose of unused paint or coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Generator: rated power, voltage, frequency, phase, power factor, duty, frame size, weight, moment of inertia.
 - .3 Turbine: rated power, rated head, speed.

2.2 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Before starting work, obtain written approval of identification system from Departmental Representative.

2.3 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.4 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.5 LANGUAGE

- .1 Identification in English.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

- .1 Provide identification only after painting has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS

- .1 Adjacent to each change in direction.
- .2 At least once in each small room through which piping passes.
- .3 On both sides of visual obstruction or where run is difficult to follow.
- .4 On both sides of separations such as walls, floors, partitions.
- .5 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .6 At beginning and end points of each run and at each piece of equipment in run.
- .7 At point immediately upstream of major manually operated or automatically controlled valves. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .8 Identification easily and accurately readable from usual operating areas and from access points.

- .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

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

3.7 CLEANING

- .1 Proceed in accordance with 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 RELATED SECTIONS

- .1 Not Used

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-(latest), Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-(latest), Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-(latest), The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 PERMITS, CERTIFICATES, AND FEES

- .1 Prior to commencement of work, submit the necessary drawings to the Electrical Inspection Department and the Electrical Supply Authority.
- .2 Pay all fees and obtain document posting as required.
- .3 On completion of work, submit Certificate of Acceptance from inspection authority to the Departmental Representative.

1.5 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.

Language operating requirements: provide identification nameplates and labels for control items in English.

1.6 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in BC, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .4 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.7 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 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
 - .1 Site Meetings: as part of Manufacturer's Field Services schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling. Dispose of waste material that cannot be reused or recycled off site in accordance with local and national regulations.

1.9 WARRANTY

- .1 Equipment furnished under this contract shall be guaranteed against defective parts and workmanship for a period of one year from the date of acceptance and shall include all labor and travel time for necessary repair at the job site.

1.10 SYSTEM STARTUP

- .1 Instruct Departmental Representative 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 with aspects of its care and operation.

1.11 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.

- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

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 is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.2 EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Departmental Representative.
- .2 Decal 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 face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .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.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

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 plastic, sized for free passage of conduit, and protruding 50 mm.

- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

- .1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .4 Systems: Incubation Temperature Control Systems and Alarms.
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .2 Carry out tests in presence of Departmental Representative.
- .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.

3.6 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

- Part 1 General**
- 1.1 RELATED REQUIREMENTS**
 - .1 Not Used.
- 1.2 REFERENCES**
 - .1 Not Used.
- 1.3 PRODUCT DATA**
 - .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

- Part 2 Products**
- 2.1 BUILDING WIRES**
 - .1 Conductors: stranded for 10 AWG and larger. Minimum size: 14 AWG.
 - .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material, jacketed, THW or RW90 C-Link for damp locations.
 - .3 Colour code to CSA C22.1 current addition.
 - .4 Aluminum conductors will not be allowed.
- 2.2 CONTROL CABLES**
 - .1 Type: 600 V annealed copper conductors, sizes as recommended by the sensor manufacturer:
 - .1 Shielding: braid over each pair of conductors.
 - .2 Overall covering: thermoplastic jacket
 - .3 Rated for Wet Locations
- 2.3 POWER CABLES**
 - .1 Induction generator conductors to be provided according to the Canadian Electric Code for the induction generator supplied.

- Part 3 Execution**
- 3.1 FIELD QUALITY CONTROL**
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductor length for parallel feeders to be identical.
- .3 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .4 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .5 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield, one end only, same end as power source.
- .3 Flowmeter signal connections per manufacturer requirements.
- .4 Future valve and gate control wires and signal cables shall be routed through the pull boxes and coiled for future connection to the future PLC. Label both ends identically with unique tag numbers.

3.5 INSTALLATION OF POWER CABLES

- .1 Install power cable in new conduit from a new circuit breaker in an MCC to the transformer primary as indicated in the drawings.
- .2 For the new lighting fixtures, Tap into the existing lighting circuit for level 20.0.
- .3 New branch circuits in new conduit per the panelboard schedule on the drawings.
 - .1 Flowmeter power connections per manufacturer requirements.
 - .2 Valve and gate power connections per manufacturer requirements.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
- .2 Canadian Standards Association, (CSA International)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle from waste materials. Dispose of waste materials off site in accordance with local and national regulations.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling.

Part 2 Products

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green.
- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install connectors in accordance with manufacturer's instructions.
- .2 Protect exposed grounding conductors from mechanical injury.

- .3 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .4 Soldered joints not permitted.
- .5 Connect motor/generator frames to ground.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, frames of motors, motor control centres, starters, control panels, generators, and distribution panels.
- .2 The magnetic flowmeters grounding rings are not equipment grounds. They are intended to reduce electromagnetic noise levels in the flowing water. Ground these per manufacturer's requirements.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-(latest), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M-(latest), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-(latest), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M-(latest), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M-(latest), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-(latest), Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (latest).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling. Dispose of waste material off site in accordance with local and national regulations.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel, threaded.

- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One hole malleable iron straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.
Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

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.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

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 datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Surface mount conduits.

- .3 Use electrical metallic tubing (EMT) except underground and in cast concrete above 2.4 m not subject to mechanical injury. Use rigid galvanized steel conduit underground and in concrete.
- .4 Use liquid tight flexible metal conduit for connection to motors, generators or vibrating equipment.
- .5 Minimum conduit size: 19 mm.
- .6 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .7 Install fish cord in empty conduits.
- .8 Dry conduits out before installing wire.

3.3 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 Do not pass conduits through structural members.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints with heavy coat of bituminous paint.

3.6 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for 250-volt and 600-volt breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Not Used.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2No.29 and 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.
- .2 600 V panelboards: bus and breakers rated for 18,000 A (symmetrical) interrupting capacity or as indicated.
- .3 250 V panelboards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.
- .4 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.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus. For three phase, four wire panelboards, neutral shall be of same amperage as mains
- .8 Have lugs or mains as shown on the drawings. Lugs of Main breakers shall be suitable for wire size shown.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked grey enamel. Enclosures shall be NEMA 12.
- .11 250-volt maximum, 3-phase, 4-wire panelboards:

- .a Square D, type NQOD
 - .b Siemens, type Sentron S1
 - .c Cutler Hammer, type CH
- .12 600-volt, 3-phase, 3-wire panelboards
- .a Square D, type I-Line
 - .b Siemens, type Sentron S2
 - .c Cutler Hammer, type PRL

2.2 BREAKERS

- .1 Breakers: shall be molded case, thermal magnetic type.
- .2 Breakers shall be bolt-on type.
- .3 Molded-in ON-OFF marking on breaker cover.
- .4 One-, two-, or three-pole as indicated.
- .5 Current and interrupting rating as indicated on the Drawings.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 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 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical.
- .3 Connect loads to circuits.
- .4 Connect neutral conductors to common neutral bus.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for non-fused disconnect switch.

1.2 RELATED SECTIONS

- .1 Not used.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

1.4 SUBMITTALS

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

1.5 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Outdoor, non-fusible, 600 V, 100 A disconnect switch in CSA Enclosure Type 4X. Disconnect shall be supplied with copper only lugs.
- .2 Disconnect shall be complete with a single pole, double throw, 20-amp auxiliary contact for interlock connection to the generator control panel.
- .3 Provision for padlocking in off switch position.
- .4 Mechanically interlocked door to prevent opening when handle in ON position.
- .5 Quick-make, quick-break action.
- .6 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switch to the manufacturers instructions.
- .2 Install disconnect switch in the location indicated on the drawings.
- .3 Label switch as indicated on the drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASME B16.1-(Latest), Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ANSI B18.2.1- (Latest), Square and Hex Bolts and Screws - Inch Series.
 - .3 ANSI B18.2.2- (Latest), Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A307-(Latest), Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
 - .2 ASTM D1785-(Latest), Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
 - .3 ASTM D2466-(Latest), Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - .4 ASTM D2467-(Latest), Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - .5 ASTM D2564-(Latest), Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems.
 - .6 ASTM D2855-(Latest), Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-B137 Series-(Latest), Thermoplastic Pressure Piping Compendium (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CSA-B137.3-(Latest), Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada and include:
 - .1 Manufacturer's certified installation drawings for all valves, strainers.
 - .2 Construction details of fabricated fittings.
 - .3 Quality control test results for fabricated fittings.
- .4 Samples:
 - .1 Submit samples and include:
 - .1 Sample of each type of fitting to be used on this project.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Record Drawings: provide as specified in Section 22 05 00 - Common Work Results - for Plumbing and include following information:
 - .1 Information relating to elevations, inverts and location of piping, branches, and anchors.
 - .2 Valve data.
 - .3 Access points.
 - .4 Details of pipe grades, vents, drip points.
 - .5 Drainage provisions at low points, manholes, valve chambers.
 - .6 Existing services uncovered during installation.
 - .7 Existing services known to exist within 3 m of installation.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling. Dispose of non-recyclable waste off site in compliance with local and national regulations

1.5 MAINTENANCE

- .1 Provide special tools for maintenance of systems and equipment in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PVC DISTRIBUTION PIPING

- .1 General:

- .1 Piping, fittings, flanges, flange gaskets, primer, cement to be product of one manufacturer.
- .2 Piping: to CSA-B137.3 and ASTM D1785.
 - .1 Schedule 40.
 - .2 To be smooth and free from imperfections.
- .3 Fittings:
 - .1 Pressure rating: same as for pipes.
 - .2 Up to NPS 250: socket type.
 - .3 NPS 300 and over: flanged type.
 - .4 Moulded fittings: to ASTM D2466 and ASTM D2467, socketted type, from PVC, compatible with piping.
 - .5 Field fabricated fittings: not permitted.
- .4 Welding Glue: to ASTM D2564: solvent based.
- .5 Provisions for Pipe Movement:
 - .1 Expansion loops: leg length to be as indicated.
 - .2 Offsets: locations, shapes, dimensions to be as indicated.
- .6 Flanged Joints:
 - .1 Flanges: PVC, conforming dimensionally to ANSI/ASME B16.1, for 1032 kPa: slip-on full faced, solvent welded to pipe.
 - .2 Gaskets: neoprene, 3 mm thick.
 - .3 Bolts and nuts: to ASTM A307, Grade B, ANSI B18.2.1, ANSI B18.2.2: stud bolts, carbon steel, semi-finished with heavy hex nuts, complete with washers.

2.2 HANGERS AND SUPPORTS

- .1 General: all supports to have large load bearing surfaces and be as approved by pipe manufacturer.
- .2 Hangers: Clevis type: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

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 datasheets.

3.2 CO-ORDINATION

- .1 Where interference occurs, Departmental Representative to approve relocation.

3.3 INSTALLATION OF PVC DISTRIBUTION PIPING SYSTEMS

- .1 As indicated and in accordance with PVC manufacturer's recommendations.
- .2 Joints:
 - .1 Solvent weld throughout except at flanges and unions.
 - .2 Threaded joints not permitted.
 - .3 Make joints in accordance with ASTM D2855, and to manufacturer's recommendations, using both primer and solvent welding cement.
 - .4 Make connections to other materials or fittings using appropriate adapters and to manufacturer's recommendations.

3.4 CHANGES IN PIPE SIZES

- .1 Install eccentric reducers at pipe size changes to ensure positive drainage or positive venting as appropriate.

3.5 HANGERS AND SUPPORTS

- .1 Support vertical piping and risers in accordance with manufacturer's recommendations.
- .2 Support valves independently of adjacent piping.
- .3 Concentrated loads: support directly or support pipe adjacent to load.
- .4 Changes in direction: support as close to fitting as possible.
- .5 Pipe movement: as indicated.
- .6 Valves: support so as to resist operating torque.
- .7 Hanger spacing: to NPS schedule 40 and 80.

NPS Schedule	Pipe Size (NPS)					
	12-25	31-38	50-75	100-150	200-300	350-400
40	1500	1800	2400	2400	3000	4200
80	1200	1500	1800	2400	2700	3300

- .8 Alignment of piping at expansion loops and offsets: align to avoid damage by movement of piping against fixed structures.

3.6 VALVES

- .1 Install in accordance with manufacturers recommendations.
- .2 Install valves at all branch take-offs, at each piece of equipment for isolation purposes and elsewhere as indicated.
- .3 Install ball check valves as indicated.

3.7 PRESSURE TESTS

- .1 Pressure test piping before concealment to 1.5 times maximum working pressure (or minimum of 250 kPa for minimum of 4 hours,) using manufacturer's recommended procedures.

3.8 PAINTING

- .1 Paint all hangers, supports, all exposed steelwork with 2 coats of rust inhibitive primer and 2 coats epoxy paint.

3.9 FIELD QUALITY CONTROL

- .1 On completion, test at maximum design flow Tests rates, operating temperatures and pressures to demonstrate compliance to design for total of 48 hours.
- .2 Certificates: upon completion, furnish certificates confirming:
 - .1 Work as installed conforms to all requirements of authority having jurisdiction.
 - .2 System operation meets all design requirements.

3.10 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

