



## Specification

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# MECHANICAL SPECIFICATIONS

Department of Fisheries and Oceans  
Sidney, BC  
Institute of Ocean Sciences  
Timber and Concrete Floats  
A, B, C & D

**Requisition No.**

Project No. 9R306-2  
Date: July 15, 2016

**APPROVED BY:**

\_\_\_\_\_  
Regional Manager AES

\_\_\_\_\_  
Date

\_\_\_\_\_  
Construction Safety Coordinator

\_\_\_\_\_  
Date

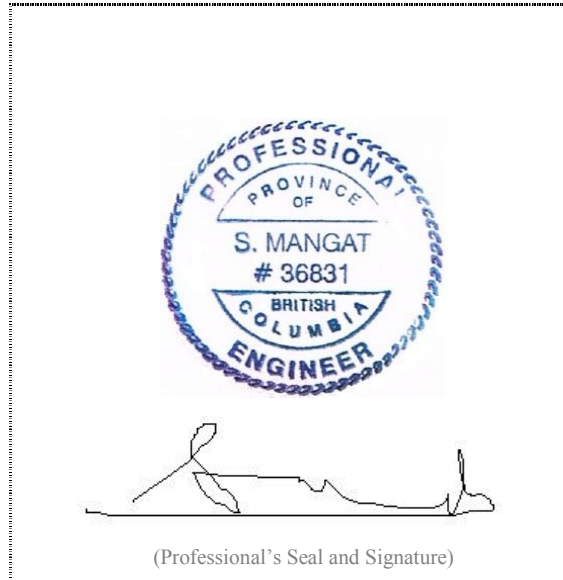
**TENDER:**

\_\_\_\_\_  
Project Manager

\_\_\_\_\_  
Date

**CONSULTANT – SEAL & SIGNATURE**

**Mechanical  
Amec Foster Wheeler Environment  
and Infrastructure**



(Professional's Seal and Signature)

August 1st 2016

Date

Date

**END OF SEALS PAGE**

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## 1.1 CODES

- .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date.

## 1.2 DESCRIPTION OF WORK

- .1 Work under this Contract covers Domestic Water and Fire System Rehabilitation for the Institute of Ocean Sciences Sidney location [B.C.]. The campus was developed in the 1970s and has been in continuous use since that time. Wharf seismic retrofit was carried out in 2002. In 2013 a Condition Assessment of the harbour facilities was undertaken by Herold Engineering Ltd and the resulting report indicated a need for upgrading and improvements to the water supply and firefighting systems on the docks.
- .2 Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract documents.
  - .1 Remove and dispose the existing infrastructure components related to Floating Docks A, B, and C in an environmentally sound manner.
  - .2 Installation of new piping and valve arrangements on new Floating Docks A, B1, B2, C and D.
  - .3 For each float, provide new water supply tie-in connections complete with related piping modifications on land and Fixed Wharf area.
  - .4 Provide new fire hydrant and hose system on north edge of the Fixed Wharf transverse section.
  - .5 Chlorinate all new piping system and commission with pressure testing.
- .3 All works to be coordinated and scheduled as per Departmental Representative's schedule and coordination. Existing facility must remain operational at all times.
- .4 Access to the site, workers and public safety will need to be included in the construction contract.
- .5 Testing and commissioning of the rehabilitation works to be part of the construction contract
- .6 "Green Requirements:
  - .1 Use only environmentally responsible green materials/products with no VOC emissions or minimum VOC emissions of indoor off-gassing contaminants for improved indoor air quality – subject of Departmental Representative's approval of submitted MSDS Product Data.
  - .2 Use materials/products containing highest percentage of recycled and recovered materials practicable – consistent with maintaining cost effective satisfactory levels of competition.
  - .3 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.

### **1.3 CONTRACT DOCUMENTS**

- .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work. Plans have been prepared with the intent that contractor will ensure/clarify the scope prior to start up and bring to the Departmental Representative's attention any error, corrections and extra work required to complete particular work.

### **1.4 DIVISION OF SPECIFICATIONS**

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

### **1.5 TIME OF COMPLETION**

- .1 The final Contract Completion is stipulated to be March 31<sup>st</sup> 2017.

### **1.6 HOURS OF WORK**

- .1 Restrictive as follows:
  - .1 The work is restricted between 0700-1800 hours.
  - .2 Schedule deconstruction, removal and construction work in a manner that existing operation is not impacted. Plan unhindered access of haul trucks to the disposal area. Obtain current mooring schedule from the Owner's Representative and schedule work according to the schedule.
  - .3 Notify and get approval from the Departmental Representative of all after hours work, including weekends and holidays.

### **1.7 WORK SCHEDULE**

- .1 Carry on work as per indicated "PHASES" and as follows:
  - .1 Within 10 working days after Contract award, provide a "phasing bar chart" and a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
    - .1 Submission of shop drawings, product data, MSDS sheets and samples.
    - .2 Commencement and completion of work of each section of the specifications or trade for each phase as outlined.
    - .3 Final completion date within the time period required by the Contract documents.

- .2 Do not change approved Schedule – without notifying Departmental Representative.
- .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

#### **1.8 COST BREAKDOWN**

- .1 Before submitting the first progress claim, submit a breakdown of the Contract Unit Price in detail as directed by the Departmental Representative and aggregating Contract price.

#### **1.9 CODES, BYLAWS, STANDARDS**

- .1 Perform work in accordance with the indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

#### **1.10 DOCUMENTS REQUIRED**

- .1 Refer to 01 11 00.

#### **1.11 REGULATORY REQUIREMENTS**

- .1 Obtain and pay for Permits, Certificates, Licenses required by regulatory municipal, provincial or federal authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.

#### **1.12 CONTRACTOR'S USE OF SITE**

- .1 Use of site:
  - .1 Contractor must coordinate with Department Representative for the use of the Site and maintain the access to the Site.
  - .2 Assume responsibility for assigned premises for performance of this work.
  - .3 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative, if any.
- .2 Perform work in accordance with Contract documents. Ensure work is carried out in accordance with indicated phasing.
- .3 Do not unreasonably encumber site with material or equipment.
- .4 Use only indicated access for moving workers and material.

- .1 Accept liability for damage, safety of existing installations and overloading of existing installations.

### **1.13 EXAMINATION**

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work. Make inquiries or investigations necessary to become thoroughly acquainted with site, soil, surface, stream and road access conditions, and the nature and extent of the work. Contractor to satisfy himself as to the condition prevailing.
- .2 Provide photographs of surrounding properties, objects and structures liable to be damaged or be the subject of subsequent claims.

### **1.14 EXISTING SERVICES**

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the authorities having jurisdiction.

### **1.15 LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual locations.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative.

### **1.16 SETTING OUT OF WORK**

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

### **1.17 ACCEPTANCE OF SUBSTRATES**

- .1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

### **1.18 QUALITY OF WORK**

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.



- .2 The workmanship, erection methods and procedures to meet minimum standards set out in the NMS Construction Standards.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

#### **1.19 WORKS COORDINATION**

- .1 Coordinate work of subtrades
  - .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
  - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
  - .2 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
    - .1 Pay particular close attention to overhead work above ceilings and within or near to building structural elements.
    - .2 Identify on coordination drawings, building elements, service lines, rough-in points and indicate location services entrance to site.
  - .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
  - .4 Publish minutes of each meeting.
  - .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
  - .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
- .4 Work coordination:
  - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
  - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
  - .3 Ensure disputes between subcontractors are resolved.
- .5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

#### **1.20 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

- .1 In accordance with Section 01 33 00, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.

.2 **Allow sufficient time for the following:**

- .1 Review of product data.
- .2 Approval of shop drawings.
- .3 Review of re-submission.

**1.21 RELICS AND ANTIQUITIES**

- .1 Relics and antiquities and items of historical or scientific interest shall remain property of the Department. Protect such articles and request directives from Departmental Representative.
- .2 Give immediate notice to Departmental Representative if evidence of archeological finds are encountered during excavation/construction, and await Departmental Representative's written instructions before proceeding with work in this area.
- .3 If significant historical or archaeological artifacts, or human remains are discovered, stop work, report it immediately to the Departmental Representative.

**1.22 SECURITY CLEARANCES**

- .1 Contractor shall be fully responsible for securing the premises and its contents throughout the construction period.

**1.23 PROJECT MEETINGS**

- .1 Meet with Departmental Representative within five (5) working days of Award of Contract date, to establish scope of Work and approach to project construction operations.

**1.24 TESTING AND INSPECTION**

- .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified in other sections.
- .2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems:
    - .1 Chlorination related water testing
    - .2 Pressure testing of installed system
    - .3 Mill tests and certificates of compliance.
    - .4 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.
- .3 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of correct work.

- .4 Contractor shall furnish labour and facilities to:
  - .1 Notify Departmental Representative in advance of planned testing.
- .5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .7 The Departmental Representative may require, and pay for, additional inspection and testing services not included in Paragraph 1.24.2.
- .8 Provide Departmental Representative with 1 copy of testing laboratory reports as soon as they are available.

#### **1.25 AS-BUILT DOCUMENTS**

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for “as-built” purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.

#### **1.26 CLEANING**

- .1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 **Ensure cleanup of the work areas each day after completion of work.**
- .3 In preparation for interim and final inspections:
  - .1 Examine all sight-exposed interior and exterior surfaced and concealed spaces.
  - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces, including glass and other polished surfaces.
- .4 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.

#### **1.27 DUST CONTROL**

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

#### **1.28 PUBLIC WAY CONSTRUCTION**

- .1 Design, erect and maintain hoarding and covered pedestrian walkways to support all loads including wind loads and provide protection, complete with signs and electrical lighting as required by authority having jurisdiction.
- .2 Provide one lockable truck entrance gate as directed and conforming to applicable traffic restrictions on adjacent street. Equip gates with locks and keys. Paint public side of site enclosure in colour selected by Departmental Representative.

**1.29 ENVIRONMENTAL PROTECTION**

- .1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.
- .2 Do not dispose of chlorinated water, waste or volatile materials into water courses, storm or sanitary sewers.
- .3 Ensure proper disposal procedures in accordance with all applicable territorial regulations.

**1.30 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS**

- .1 Specific requirements for maintenance materials, tools and spare parts are specified in individual sections.

**1.31 ADDITIONAL DRAWINGS**

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 5 sets of Contract documents for use by the Contractor at no additional cost. Should more than 5 sets of documents be required the Departmental Representative will provide them at additional cost.

**1.32 BUILDING SMOKING ENVIRONMENT**

- .1 Smoking within the building is not permitted.

**1.33 SYSTEM OF MEASUREMENT**

- .1 The metric system of measurement (SI) will be employed on this Contract.

**1.34 FAMILIARIZATION WITH SITE**

- .1 Before submitting tender, visit site – as indicated in tender documents and become familiar with all **conditions likely to affect the cost of the work**.

**1.35 SUBMISSION OF TENDER**

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

**END OF SECTION**

**Part 1           General**

**1.1           PURPOSE**

- .1       To ensure that both the construction project and the facility operations may proceed without undue disruption or hindrance and that the security of the facility is maintained at all times.

**1.2           DEFINITIONS**

- .1       "Contraband" means:
  - .1       an intoxicant, including alcoholic beverages, drugs and narcotics;
  - .2       a weapon, or a component thereof;
  - .3       an explosive material or compound, or a component thereof, and;
  - .4       any item not described in paragraphs (.1) to (.3) that could jeopardize the security or the safety of workers or facility persons, when that item is possessed without prior authorization.
- .2       "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .3       "DFO" means Department of Fisheries and Oceans (Canada).
- .4       "IOS" means Institute of Ocean Sciences.
- .5       "Construction employees" mean persons working for the General Contractor, the sub-Contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .6       "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.
- .7       "Perimeter" means the fenced & parking compound limits of the IoS facility site.
- .8       "Construction limits" means the area, as indicated in the contract documents, that the Contractor will be allowed to work. This area may or may not be isolated from the Hangar areas of the IoS facility site. Limits to be confirmed at the construction start-up meeting.

**1.3           PRELIMINARY PROCEEDINGS**

- .1       At construction start-up meeting:
  - .1       Discuss the nature and extent of all activities involved in the Project.
  - .2       Establish mutually acceptable security procedures in accordance with this instruction and the facility's particular requirements.
- .2       The Contractor's responsibilities:
  - .1       Ensure that all construction employees are aware of the security requirements;
  - .2       Co-operate with the facility's personnel in ensuring that security requirements are observed by all construction employees.

#### **1.4 CONSTRUCTION EMPLOYEES**

- .1 Entry to facility's property will be refused to any person there may be reason to believe may be a health or security risk.
- .2 Any person employed on the construction site will be subject to immediate dismissal from property if they:
  - .1 appear to be under the influence of alcohol, drugs or narcotics;
  - .2 behave in an unusual or disorderly manner;
  - .3 are in possession of 'contraband'.

#### **1.5 VEHICLES**

- .1 All unattended vehicles on property must have windows closed, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle in the event the vehicle is required to be moved.
- .2 The Departmental Representative may limit at any time the number and type of vehicles allowed on the premises.
- .3 Drivers of delivery vehicles for material required by the project will be allowed on the premises to coordinate the delivery with the Contractor. Upon delivery they will be required to move their vehicles.
- .4 Where Departmental Representative allows construction trailers to be left inside the construction area of the site perimeter, the trailer doors must be locked at all times. All windows must be securely locked when left unoccupied.

#### **1.6 PARKING**

- .1 The parking area(s) to be used by construction employees will be designated by the Departmental Representative. Parking in other locations will be prohibited and vehicles may be subject to removal.

#### **1.7 SHIPMENTS**

- .1 To avoid confusion with the facility's own shipments, address all shipments of project material, equipment and tools in the Contractors name and have a representative on site to receive any deliveries or shipments. PWGSC and IoS staff will **NOT** accept receipt of deliveries or shipments of any material, equipment or tools.

#### **1.8 TELEPHONES**

- .1 The installation of telephones, facsimile machines and computers with internet connections maybe permitted within the facility with the approval of the Departmental Representative.
- .2 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, telephones used as 2-way radios are permitted within the construction area.
- .3 The Departmental Representative may limit the use of 2-way radios, where a disruption to facility operation could occur.

## **1.9 WORK HOURS**

- .1 Conform to Section 01 11 55.
- .2 A minimum of (72) hours advance notice will be required to obtain permission for work on weekends. In case of emergencies or other special circumstances, this advance notice may be waived by the Departmental Representative.

## **1.10 OVERTIME WORK**

- .1 Provide (72) hours advance notice to Departmental Representative for all work to be performed after normal working hours of the facility. Notify the Departmental Representative immediately if emergency work is required, such as to complete remediation's or make the construction site safe and secure.

## **1.11 ESCORT (COMMISSIONAIRE)**

- .1 General
  - .1 The Contractor may require a qualified escort (Commissionaire) during certain times of the work. The Contractor is responsible for providing an estimate of the services (in hours) to be included in their tender submission.
  - .2 The Commissionaire service and all other associated costs for the Commissionaire are to be carried by the Contractor in the tender.
- .2 Allowance
  - .1 The Contractor shall allow the following rates for the commissionaire services:
    - .1 At the current hourly rates for Commissionaire services up to eight (8) hours per day.
    - .2 At the current hourly overtime rate for Commissionaire services in excess of eight (8) hours per day.
    - .3 The Contractor shall review the Contract Documents and submit within the tender, an allowance of what they regard as the required time needed for the Commissionaire services.
    - .4 Retain Commissionaire services and coordinate rates directly with the Commissionaires agent by contacting the service directly at: [operationscentre@commissionaires.bc.ca](mailto:operationscentre@commissionaires.bc.ca)
- .3 Schedule
  - .1 The Contractor shall provide to the Departmental Representative a minimum of 48 hour notice in advance of when the commissionaire services will be required.
- .4 Payment
  - .1 The cost for the commissionaire will be assessed towards the contract by change order.

## **1.12 TOOLS AND EQUIPMENT**

- .1 Where requested maintain a complete list of all tools and equipment to be used during the construction project.

- .2 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .3 Store all tools and equipment in approved locations.
- .4 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the Contractor. Secure and lock scaffolding when not erected and when erected secure in a manner agreed upon with the Departmental Representative.

#### **1.13 SMOKING RESTRICTIONS**

- .1 Smoking is not permitted inside the facility or outdoors within the perimeter of the facility.
- .2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist may be directed to leave the site.
- .3 Smoking is permitted outside the perimeter of the facility in an area designated by the Departmental Representative.

#### **1.14 CONTRABAND**

- .1 Weapons, explosive materials, alcoholic beverages, drugs and narcotics are prohibited on the site.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Departmental Representative.
- .3 Contractors should be vigilant with both their employees and the employees of their subcontractors, vendors and suppliers that the discovery of contraband may result in immediate dismissal of the identified individual(s).

#### **1.15 ACCESS TO AND REMOVAL OF FACILITY PROPERTY**

- .1 Construction personnel and commercial vehicles will not be admitted to the facility after normal working hours, unless arranged and approved by the Departmental Representative.

#### **1.16 STOPPAGE OF WORK**

- .1 The Departmental Representative may request at any time that the Contractor, his employees, subcontractors and their employees stop work or leave the site immediately due to any situation occurring within the facility. The Contractor's site supervisor shall note the name of the facility personnel making the request and the time of the request and follow all given directions.
- .2 The Contractor shall advise the Departmental Representative within (24) hours of this delay to the progress of the work.

**END OF SECTION**



- Part 1            General**
- 1.1                RELATED SECTIONS**
- .1              All Divisions.
- 1.2                DESCRIPTION**
- .1              Mobilization and Demobilization consists of the necessary Work and operations including, but not limited to, the movement to and from the project site of personnel, equipment, supplies, and incidentals to the Site, the establishment of offices, camps, and other facilities necessary to undertake the Work and all other Work Items and operations which must be initiated and finished as part of completion of the Work.
- 1.3                MEASUREMENT PROCEDURES**
- .1              Payment will be made under “**Lump Sum Price Item 1 - Mobilization and Demobilization**”.
- .2              The Lump Sum Price for mobilization and demobilization includes any or all of the related expenses incurred for mobilization, demobilization and any re-mobilization not covered under the Work Items which must be initiated and finished as part of the Work. The Lump Sum Price for mobilization will be paid in increments as the Work progresses.
- Part 2            Products**
- .1              Not Used.
- Part 3            Execution**
- .1              Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

.1            All Divisions.

**1.2                PRECEDENCE**

.1            For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this specifications document.

**1.3                MEASUREMENT PROCEDURES**

.1            Cost of providing Construction Progress Schedules will be considered incidental to the work and no additional payment will be made.

**1.4                DEFINITIONS**

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

.2            **Bar Chart (GANTT chart):** A graphic display of schedule-related information. In typical bar chart, activities or other project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3            **Baseline:** Original approved plan for project, 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            **Duration:** Number of work periods (not including holidays or other nonworking periods) required to complete an activity or other project element, usually expressed as work days or work weeks.

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

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

.8            **Project Schedule:** The planned dates for performing activities and the planned dates for meeting milestones. A dynamic, detailed record of tasks or activities that must be accomplished to satisfy project objectives. Monitoring and control

process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

- .9 **Project Planning, Monitoring and Control System:** Overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

## **1.5 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 twenty (20) 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.

## **1.6 SUBMITTALS**

- .1 Submit to Departmental Representative within ten (10) working days of Award of Contract, Bar Chart (GANTT) as Master Plan for planning, monitoring and reporting of project progress.
- .2 Submit Project Schedule to Departmental Representative within ten (10) working days of receipt of acceptance of Master Plan.

## **1.7 PROJECT MILESTONES**

- .1 Refer to Other Contract Documents.

## **1.8 MASTER PLAN**

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

## **1.9 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award.
  - .2 Permits.
  - .3 Submission of:
    - .1 Project Schedule.
    - .2 List of Sub-Contractors, supplies and Departmental Representative.
    - .3 Prime Contractor/co-ordination with other Contractors Plan.
    - .4 Contractor Chain of Command including Sub-Contractors and Departmental Representatives.
    - .5 Work Plan.
    - .6 Environmental Protection Plan.
    - .7 Traffic Management Plan.
    - .8 Campsite Plan.
    - .9 Site access/Detour Plan.
    - .10 Emergency Response Protocol.
    - .11 Site Specific Health and Safety Plan, incl. MSDS sheets.
    - .12 On site Contingency and Emergency Response Plan.
    - .13 Survey Plan.
    - .14 Quality Control Plan.
    - .15 Shop Drawings.
  - .4 Mobilization.
  - .5 Material Delivery.

- .6 Work for all Items including:
  - .1 Demolition
  - .2 Quality Control.
  - .3 Interim inspection.
  - .4 Site clean-up and demobilization.

**1.10 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on monthly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

**1.11 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.

**Part 2 Products**

- .1 Not used.

**Part 3 Execution**

- .1 Not used.

**END OF SECTION**

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**1.1 GENERAL**

- .1 This Section specifies general requirements and procedures for the Contractor's submissions of shop drawings, product data, samples and other requested submittals to Departmental Representative for review. Additional specific requirements for submissions are specified in individual technical sections.
- .2 Present shop drawings, product data and samples in SI Metric units.
- .3 Where items or information is not produced in SI Metric units, converted values are acceptable.
- .4 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submissions.
- .5 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract documents and stating reasons for deviations.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Departmental Representative's review of submission unless Departmental Representative gives written acceptance of specific deviations.
- .7 Make any changes in submissions which Departmental Representative may require consistent with Contract documents and resubmit as directed by Departmental Representative.
- .8 Notify Departmental Representative in writing, when resubmitting, of any revisions other than those requested by Departmental Representative.
- .9 **Do not proceed with work until relevant submissions are reviewed and approved by the Departmental Representative.**

**1.2 SUBMISSION REQUIREMENTS**

- .1 Coordinate each submission with the requirements of the work and the Contract documents. Individual submissions will not be reviewed until all related information is available.
- .2 Allow 5 [five] working days for Departmental Representative's review of each submission, unless noted otherwise.
- .3 Accompany submissions with transmittal letter, in duplicate, 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.
- .4 Submissions shall 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.
  - .6 After Departmental Representative's review, distribute copies.

### **1.3 SHOP DRAWINGS**

- .1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portion of work which are specific to project requirements.

- .2 Maximum sheet size: 850 x 1050 mm.
- .3 Submit electronic copy in PDF format and two copies of larger size files in CD format as requested by the Departmental Representative.
- .4 Cross-reference shop drawing information to applicable portions of the Contract documents.

#### **1.4 SHOP DRAWINGS REVIEW**

- .1 Review of shop drawings by Public Works and Government Services Canada is for the sole purpose of ascertaining conformance with the general concept.
- .2 This review shall not mean that Public Works and Government Services Canada approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same.
- .3 This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract documents.
- .4 Without restricting the generality of the foregoing, the Contractor is responsible for:
  - .1 Dimensions to be confirmed and correlated at the job site.
  - .2 Information that pertains solely to fabrication processes or to techniques of construction and installation.
  - .3 Coordination of the work of all sub-trades.

#### **1.5 PRODUCT DATA**

- .1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products or any other specified information.
- .2 Delete information not applicable to project.
- .3 Supplement standard information to provide details applicable to project.
- .4 Cross-reference product data information to applicable portions of Contract documents.
- .5 Submit 6 copies of product data.

#### **1.6 SAMPLES**

- .1 Samples: examples of materials, equipment, quality, finishes and workmanship.
- .2 Where colour, pattern or texture is a criterion, submit a full range of samples.



- .3 **Reviewed and accepted samples will become the standard of workmanship and material against which installed work will be verified.**

**1.7 PROGRESS SCHEDULE**

- .1 Submit work schedule and cost breakdown as required in Section 01 11 55.

**1.8 TEST RESULTS AND INSPECTION REPORTS**

- .1 Submit in duplicate test results and inspection reports.

**END OF SECTION**

**1.1 PREFERENCES**

- .1 Government of Canada.
  - .1 Canada Labour Code – Part II
  - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC):
  - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA) as amended:
  - .1 CSA Z797-2009 Code of Practice for Access Scaffold
  - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
  - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Fire Protection Engineering Services, HRSDC:
  - .1 FCC No. 301, Standard for Construction Operations.
  - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
  - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia::
  - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
  - .2 Occupational Health and Safety Regulation
- .7 Yukon Territory
  - .1 Occupational Health and Safety Act, R.S.Y.

**1.2 RELATED SECTIONS**

- .1 Refer to the following current NMS sections as required:
  - .1 Construction Progress Schedules Section 01 32 18
  - .2 Shop Drawings, Product Data and Samples Section 01 33 00

.3	Environmental Procedures	Section 01 35 43
.4	Temporary Facilities	Section 01 51 00
.5	Temporary barriers and enclosures:	Section 01 56 00

### **1.3 WORKERS' COMPENSATION BOARD COVERAGE**

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

### **1.4 COMPLIANCE WITH REGULATIONS**

- .1 Departmental Representative may terminate the Contract without liability to Departmental Representative where the Contractor, in the opinion of Departmental Representative, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

### **1.5 SUBMITTALS**

- .1 Submit to Departmental Representative submittals listed for review.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
  - .1 Health and Safety Plan.
  - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
  - .3 Copies of incident and accident reports.
  - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
  - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within

7 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

- .5 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.
- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
  - .1 Be construed to imply approval by the Departmental Representative.
  - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
  - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

## **1.6 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.
- .3 Assume responsibility as the Prime Contractor for Work under this Contract.

## **1.7 GENERAL CONDITIONS**

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
  - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
  - .2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

## **1.8 REGULATORY REQUIREMENTS**

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

#### **1.9 WORK PERMITS**

- .1 Obtain specialty permits related to project before start of work.

#### **1.10 FILING OF NOTICE**

- .1 Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

#### **1.11 HEALTH AND SAFETY PLAN**

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
  - .1 Primary requirements:
    - .1 Contractor's safety policy.
    - .2 Identification of applicable compliance obligations.
    - .3 Definition of responsibilities for project safety/organization chart for project.
    - .4 General safety rules for project.
    - .5 Job-specific safe work, procedures.
    - .6 Inspection policy and procedures.
    - .7 Incident reporting and investigation policy and procedures.
    - .8 Occupational Health and Safety Committee/Representative procedures.
    - .9 Occupational Health and Safety meetings.
    - .10 Occupational Health and Safety communications and record keeping procedures.

- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
  - .3 List hazardous materials to be brought on site as required by work.
  - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
  - .5 Identify personal protective equipment (PPE) to be used by workers.
  - .6 Identify personnel and alternates responsible for site safety and health.
  - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
  - .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
  - .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

#### **1.12 EMERGENCY PROCEDURES**

- 1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
    - .1 Designated personnel from own company.
    - .2 Regulatory agencies applicable to work and as per legislated regulations.
    - .3 Local emergency resources.
    - .4 Departmental Representative.
- Include the following provisions in the emergency procedures:
- .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
  - .2 Evacuate all workers safely.
  - .3 Check and confirm the safe evacuation of all workers.

- .4 Notify the fire Departmental or other emergency responders.
- .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
- .6 Notify Departmental Representative.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
  - .1 Work at high angles.
  - .2 Work in confined spaces or where there is a risk of entrapment.
  - .3 Work with hazardous substances.
  - .4 Underground work.
  - .5 Work on, over, under and adjacent to water.
  - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

### **1.13 HAZARDOUS PRODUCTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
  - .1 Advise Departmental Representative beforehand of the products intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.
  - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.
  - .3 Provide adequate means of ventilation in accordance with Section 01 51 00.

### **1.14 ELECTRICAL SAFETY REQUIREMENTS**

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

- .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.
- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

**1.15 ELECTRICAL LOCKOUT**

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

**1.16 OVERLOADING**

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

**1.17 FALSEWORK**

- .1 Design and construct falsework in accordance with CSA S269.1-1975 (R2003).

**1.18 SCAFFOLDING**

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 and B.C. Occupational Health and Safety Regulations.

**1.19 CONFINED SPACES**

- .1 Carry out work in confined spaces in compliance with Provincial regulations. Special attention to the works on CRIB 1 to 8 that might be considered confined spaces.

**1.20 POWDER-ACTUATED DEVICES**

- .1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

**1.21 FIRE SAFETY AND HOT WORK**

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.



- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

#### **1.22 FIRE SAFETY REQUIREMENTS**

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

#### **1.23 FIRE PROTECTION AND ALARM SYSTEM**

- .1 Fire protection and alarm systems shall not be:
  - .1 Obstructed.
  - .2 Shut off.
  - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire Departmental, the building owner and the tenants, resulting from false alarms.

#### **1.24 UNFORESEEN HAZARDS**

- .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

#### **1.25 POSTED DOCUMENTS**

- .1 Post legible versions of the following documents on site:
  - .1 Health and Safety Plan.
  - .2 Sequence of work.
  - .3 Emergency procedures.
  - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
  - .5 Notice of Project.
  - .6 Floor plans or site plans.

- .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
- .8 Workplace Hazardous Materials Information System (WHMIS) documents.
- .9 Material Safety Data Sheets (MSDS).
- .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

**1.26 MEETINGS**

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

**1.27 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 02 41 13.

**1.2                REFERENCES**

- .1            Definitions:
  - .1            Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
  - .2            Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
- .2            Reference Standards:
  - .1            Canadian Construction Documents Committee (CCDC)
    - .1            CCDC 2-2008 Stipulated Price Contract.
  - .2            U.S. Environmental Protection Agency (EPA)/Office of Water
    - .1            EPA 832/R-92-005-[92], Storm Water Management for Construction Activities, Chapter 3.
    - .2            EPA General Construction Permit (GCP) [2012].

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2            Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- .3            Sustainable Design Submittals:
- .4            Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.

- .5 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .6 Address topics at level of detail commensurate with environmental issue and required construction task[s].
- .7 Include in Environmental Protection Plan:
  - .1 Name[s] of person[s] responsible for ensuring adherence to Environmental Protection Plan.
  - .2 Name[s] and qualifications of person[s] responsible for manifesting hazardous waste to be removed from site.
  - .3 Name[s] and qualifications of person[s] responsible for training site personnel.
  - .4 Descriptions of environmental protection personnel training program.
  - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations [and EPA 832/R-92-005, Chapter 3].
  - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
  - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
    - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
  - .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
    - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
  - .9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
  - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
  - .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

- .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .13 Waste Water Management Plan identifying methods and procedures for management discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

#### **1.4 FIRES**

- .1 Fires and burning of rubbish on site is not permitted unless specifically approved by Departmental Representative.

#### **1.5 DRAINAGE**

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations[, EPA 832/R-92-005, Chapter 3 ] [US EPA General Construction Permit].
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials and chlorine.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

#### **1.6 SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of [2] m minimum.
- .2 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
  - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

- .3 Minimize stripping of topsoil and vegetation.

#### **1.7 POLLUTION CONTROL**

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
  - .1 Provide temporary enclosures where directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

#### **1.8 HISTORICAL/ARCHAEOLOGICAL CONTROL**

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

#### **1.9 NOTIFICATION**

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
  - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

**Part 2            Products**

**2.1                NOT USED**

- .1    Not Used.

**Part 3            Execution**

**3.1                CLEANING**

- .1    Leave Work area clean at end of each day.
- .2    Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.
- .3    Ensure public waterways, storm and sanitary sewers remain free of chlorinated water, waste and volatile materials disposal.
- .4    Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .5    Waste Management: separate waste materials for recycling.
  - .1    Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1      General**

**1.1      SUBMITTAL**

- .1      Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- .2      Erosion – and Sedimentation – Control Plan.
- .3      Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

**1.2      ACCESS AND DELIVERY**

- .1      Only the designated entrance may be used for access to the facility.
  - .1      Maintain for duration of Contract.
  - .2      Make good damage resulting from Contractor's use.
- .2      All contractors are required to use only the main entrance.
- .3      Any other use of the facility will be granted to the Contractor through the Departmental Representative.
  - .1      Unauthorized disposal is not permitted.
- .4      Flag Persons: Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.
- .5      Flares and Lights: Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.
- .6      Haul Routes:
  - .1      Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
  - .2      Confine construction traffic to designated haul routes.
  - .3      Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.
- .7      Traffic Signs and Signals:
  - .1      Provide signs approaches to site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.



- .2 Provide, operate, and maintain traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.
- .3 Relocate as Work progresses, to maintain effective traffic control.

### **1.3 STORAGE FACILITIES**

- .1 Storage space will be limited to the area of construction.

### **1.4 POWER**

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, and any other power requirements necessary for completion of the Work.
- .2 Provide and maintain temporary lighting necessary for the performance of the Work under this contract. Illumination levels shall be in accordance with WorkSafe BC requirements.

### **1.5 WATER SUPPLY**

- .1 Water supply is available at the site. Contractor to arrange if needed for personal or construction use previous approval by Departmental Representative. The Contractor shall furnish all necessary pipe or hose extensions to conduct the water to the points of use and shall exercise due care not to waste water.

### **1.6 SANITARY FACILITIES**

- .1 No washroom facilities are available onsite. Contractor to arrange portable unit if needed. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the PWGSC, or on adjacent property.

### **1.7 HEATING**

- .1 No source of heating exists onsite. Contractor to arrange if needed. If temporary heat is required for the protection of the Work, the Contractor shall provide and install suitable heating apparatus, shall provide adequate and proper fuel, and shall maintain heat as required.
- .2 Temporary heating apparatus shall be installed and operated in such manner that finished work will not be damaged thereby. The Contractor may, at his own risk and expense, use it for providing heat for protection of the Work. Contractor shall provide and pay for all fuel and care necessary.

### **1.8 SCAFFOLDING**

- .1 If needed, construct and maintain scaffolding in rigid, secure and safe manner.

- .2 Erect independent scaffolding. Remove promptly when no longer required.

**1.9 REMOVAL OF TEMPORARY FACILITIES**

- .1 Remove temporary facilities from site when directed by the Departmental Representative.

**1.10 SIGNS AND NOTICES**

- .1 Signs and notices for safety and instruction shall be in both official languages and graphic symbols conforming to CAN/CSA-Z321.
- .2 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or when directed by Departmental Representative.

**1.11 USE CHARGES**

- .1 General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Departmental Representative, testing agencies, and authorities having jurisdiction.

**END OF SECTION**

**Part 1        General**

**1.1            RELATED REQUIREMENTS**

- .1        Sections 01 51 00.

**1.2            REFERENCES**

- .1        Canadian General Standards Board (CGSB)
  - .1        CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.
  - .2        CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.
- .2        Canadian Standards Association (CSA International)
  - .1        CSA-O121-[M1978(R2003)], Douglas Fir Plywood.
- .3        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            INSTALLATION AND REMOVAL**

- .1        Provide temporary controls in order to execute Work expeditiously.
- .2        Remove from site all such work after use.

**1.4            HOARDING**

- .1        Erect temporary site enclosures using [38 x 89] mm construction grade lumber framing at [600] mm centres and [1200 x 2400 x 13] mm exterior grade fir plywood to CSA O121.
- .2        Apply plywood panels vertically flush and butt jointed.
- .3        Provide one lockable truck entrance gate as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .4        Erect temporary site enclosure using new [1.2] m high snow fence wired to rolled steel "T" bar fence posts spaced at [2.4] m on centre. Provide [one] lockable truck gate. Maintain fence in good repair.
- .5        Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

**1.5            GUARD RAILS AND BARRICADES**

- .1        Provide secure, rigid guard rails and barricades around marine water, deep excavations, open shafts, and unsecured structures.

- .2 Provide as required by governing authorities.

**1.6 WEATHER ENCLOSURES**

- .1 Provide weather tight closures to equipment that require as per manufacturer's recommendations.

**1.7 ACCESS TO SITE**

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

**1.8 PUBLIC TRAFFIC FLOW**

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

**1.9 FIRE ROUTES**

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

**1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

**1.11 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse/recycling.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1.1 PRODUCTS/MATERIAL AND EQUIPMENT**

- .1 Use NEW products/material and equipment unless otherwise specified. The term “products” is referred to throughout the specifications.
- .2 Use products of 1 manufacturer for material and equipment of the same type or classification unless otherwise specified.
- .3 Unless otherwise specified, comply with manufacturer’s latest printed instructions for materials and installation methods.
- .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer’s instructions. Departmental Representative will designate which document is to be followed.
- .5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.
  - .1 Prevent electrolytic action between dissimilar metals.
  - .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.
- .6 Fastenings which cause spalling or cracking are not acceptable.
- .7 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .8 Use heavy hexagon heads, semi-finished unless otherwise specified.
- .9 Bolts may not project more than 1 diameter beyond nuts.
- .10 Types of washers as follows:
  - .1 Plain type washers: use on equipment and sheet metal.
  - .2 Soft gasket lock type washers: use where vibrations occur.
  - .3 Resilient washers: use with stainless steel.
- .11 Deliver, store and maintain packaged material and equipment with manufacturer’s seals and labels intact.
- .12 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.
- .13 Store products in accordance with suppliers’ instructions.
- .14 Touch up damaged factory finished surfaces to Departmental Representative’s satisfaction:

- .1 Use primer or enamel to match original.
- .2 Do not paint over nameplates.

## **1.2 QUALITY OF PRODUCTS**

- .1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.
- .2 Defective products will be rejected regardless of previous inspections.
  - .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
  - .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
- .4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

## **1.3 AVAILABILITY OF PRODUCTS**

- .1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.
- .2 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 the work.
- .3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

#### 1.4 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer's instructions.
  - .1 Do not rely on labels or enclosures provided with products.
  - .2 Obtain written instructions directly from the manufacturer.
- .2 Notify Departmental Representative in writing of conflicts between the specifications and the manufacturer's instructions so that the Departmental Representative may establish the course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in either the Contract price of the Contract time.

#### 1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

- .1 Products are specified by "**Prescriptive**" specifications: select any product meeting or exceeding specifications.
- .2 Products specified under "**Acceptable Products**" (used for complex Mechanical or Electrical Systems): select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
- .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".
- .5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer and independent laboratory report showing that the product meets or exceeds the specified requirements.

#### 1.6 SUBSTITUTION AFTER CONTRACT AWARD

- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
- .2 **Proposals for substitution may only be submitted after Contract award.** Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by the Departmental Representative if:

- .1 products selected by tenderer from those specified are not available;
- .2 delivery date of products selected from those specified would unduly delay completion of Contract, or
- .3 alternative product to that specified, which is brought to the attention of considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
- .4 **Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.**
- .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Construction Documents Committee (CCDC)
  - .1        CCDC 2-94, Stipulated Price Contract.
  - .2        DOCUMENT 14 – 2000, Design-Build Stipulated Price Contract (CCA, CSC, RAIC).
  - .3        DOCUMENT 15 - 2000, Design-Builder/Consultant Contract (CCA, CSC, RAIC).

**1.2                QUALIFICATIONS OF SURVEYOR**

- .1        Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

**1.3                SURVEY REFERENCE POINTS**

- .1        Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2        Make no changes or relocations without prior written notice to Departmental Representative.
- .3        Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4        Require surveyor to replace control points in accordance with original survey control.

**1.4                SURVEY REQUIREMENTS**

- .1        Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2        Establish lines and levels, locate and lay out, by instrumentation.
- .3        Establish pipe invert elevations.
- .4        Establish lines and levels for mechanical work.
- .5        Confirm piping lengths required.

## **1.5 EXISTING SERVICES**

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

## **1.6 LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

## **1.7 RECORDS**

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

## **1.8 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

## **1.9 SUBSURFACE CONDITIONS**

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                PRECEDENCE**

- .1        For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Specifications document.

**1.2                RELATED SECTION**

- .1        Section 01 25 20 – Mobilization and Demobilization
- .2        Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.
- .3        Section 01 33 00 – Shop Drawings, Product Data and Samples
- .4        Section 01 35 43 – Environmental Procedures
- .5        Section 01 78 00 – Closeout Procedures

**1.3                MEASUREMENT PROCEDURES**

- .1        This work shall be considered incidental to contract and will not be measured for payment.

**1.4                PROJECT CLEANLINESS**

- .1        Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2        Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3        Clear snow and ice from access to work areas during active construction periods and when access to environmental protection facilities required outside active construction times.
- .4        Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5        Provide on-site bear proof containers for collection of waste materials and debris.
- .6        Remove waste material and debris from site at end of each working day.
- .7        Dispose of waste materials and debris off site.
- .8        Store volatile waste in covered metal containers, and remove from premises at end of each working day.

- .9 Provide adequate ventilation during use of volatile or noxious substances.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

**1.5 FINAL CLEANING**

- .1 When work is substantially completed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .3 Remove waste products and debris including that caused by Owner or other Contractors.
- .4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Inspect finishes, and ensure specified workmanship and operation.
- .7 Remove dirt and other disfiguration from exterior surfaces.
- .8 Sweep and wash clean paved areas.
- .9 Clean drainage systems.

**Part 2 Products**

- .1 Not Used.

**Part 3 Execution**

- .1 Not Used.

**END OF SECTION**

## **Part 1        General**

### **1.1            DEFINITIONS**

- .1        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.
- .2        Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .3        Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4        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.
- .5        Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  - .1        Salvaging reusable materials from re-modeling 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.
- .6        Salvage: Removal of structural and non-structural materials from deconstruction/ disassembly projects for purpose of reuse or recycling.
- .7        Separate Condition: Refers to waste sorted into individual types.
- .8        Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
- .9        Waste Audit (WA): Detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction. Indicates quantities of reuse, recycling and landfill.
- .10      Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials.

### **1.2            DOCUMENTS**

- .1        Maintain at job site, one copy of following documents:
  - .1        Waste Audit.
  - .2        Waste Reduction Workplan.
  - .3        Material Source Separation Plan.

### **1.3            MATERIALS SOURCE SEPARATION**

- .1        Before project start-up prepare Materials Source Separation Program (MSSP) and provide containers to deposit re-usable and/or recyclable materials of the following:
  - .1        Metals;
  - .2        Wood;

- .3 Cardboard;
  - .4 Plastics;
  - .5 Other materials as indicated in technical sections.
- .2 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form:
    - .1 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
    - .2 For each material reused, sold or recycled from project, include amount and the destination.
    - .3 For each material land filled or incinerated from project, include amount of material and identity of landfill, incinerator or transfer station.
  - .3 Implement Materials Source Separation Program (MSSP) for waste generated on project in compliance with methods as approved by Departmental Representative.
  - .4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
  - .5 Provide inventory of quantities of demolition materials to be salvaged for reuse, recycling, or disposal.

#### **1.4 DIVERSION OF MATERIALS**

- .1 Create a list of materials for separation from the general waste stream and stockpiled in separate containers, in compliance with fire regulations and to Departmental Representative's approval.
- .2 Mark containers and provide instruction on disposal practices.

#### **1.5 STORAGE, HANDLING AND APPLICATION**

- .1 Conform to Waste Reduction Work Plan.
- .2 Handle waste materials not being reused, salvaged or recycled in accordance with authority having jurisdiction and fire regulations.
- .3 Collect, handle, store on site and transport off-site, all materials in separated condition, to an approved and authorized recycling facility.
- .4 Provide Departmental Representative with receipts indicating quantity of material delivered to landfill.
- .5 Except as specified otherwise, materials removed from the site become the contractor's responsibility.
- .6 On-site sale of salvaged/recycled material is not permitted.

**END OF SECTION**

**Part 1           General**

**1.1           SECTION INCLUDES**

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

**1.2           RELATED SECTIONS**

- .1       Section 01 78 00 – Closeout Submittals.
- .2       Section 01 91 00 – Commissioning.

**1.3           INSPECTION AND DECLARATION**

- .1       Contractor's Inspection: Contractor and all subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1       Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2       Request Departmental Representative's inspection.
- .2       Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3       Completion: submit written certificate that following have been performed:
  - .1       Work has been completed and inspected for compliance with Contract Documents.
  - .2       Defects have been corrected and deficiencies have been completed.
  - .3       Equipment and systems have been tested and adjusted, and are fully operational.
  - .4       Certificates required by Authorities Having Jurisdiction.
  - .5       Commissioning of the systems: final commissioning reports have been submitted to the Departmental Representative.
  - .6       Operations of systems have been demonstrated to facility personnel.
  - .7       Work is complete and ready for Final Inspection.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 11 55 – General Instructions.
- .2        Section 01 91 00 – Commissioning.
- .3        Section 01 91 33 – Commissioning Forms.

**1.2                SUBMISSION**

- .1        Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2        Copy will be returned after final inspection, with Departmental Representative's comments.
- .3        Revise content of documents as required prior to final submittal.
- .4        At the time of Interim Completion (four weeks prior to Substantial Performance) of the Work, submit to the Departmental Representative, two (2) draft copies of the Operating and Maintenance Manuals, in English.
- .5        At the time of Substantial Performance of the Work, submit to the Departmental Representative, two (2) updated copies of the Operating and Maintenance Manuals, in English.
- .6        At the time of Total Completion of the Work, submit to the Departmental Representative, the following Operating and Maintenance Manuals, in English.
  - .1        Electronic (soft) copies of the Operating and Maintenance Manual System as required as specified under clause 1.3. Provide four (4) sets (on either CD-R, or removable USB drive) of the Electronic Operating and Maintenance Manual System to the Departmental Representative.
  - .2        Printed (hard) copies of the Operating and Maintenance Manual System are required as specified under clause 1.4. Provide four (4) printed sets of the Operating and Maintenance Manual System to the Departmental Representative.
- .7        Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .8        If requested, furnish evidence as to type, source and quality of products provided.
- .9        Defective products will be rejected, regardless of previous inspections. Replace products with **NO** additional cost to the contract.
- .10      Pay costs of transportation.

**1.3                OPERATING AND MAINTENANCE MANUAL SYSTEM**

- .1        In addition to the printed copies, submit provide an Operating and Maintenance Manual System as specified herein.
- .2        System Description and Requirements

- .1 All as constructed drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Document File (PDF) format for viewing using the Adobe Acrobat Reader or other compatible PDF viewing applications.
- .2 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:
  - .1 Electrical
  - .2 Mechanical
- .3 Under each discipline, data shall be grouped into the following four major categories:
  - .1 Basic Documents
    - .1 'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the facility. In general the following shall be included, unless specifically excluded by the Departmental Representative:
      - .1 Introduction;
      - .2 Consultant/Contractor/Suppliers list;
      - .3 System(s) description;
      - .4 Testing and commissioning (T&C) reports;
      - .5 Equipment data (specification sheets);
      - .6 Manufacturers recommended maintenance;
      - .7 Permit copies;
      - .8 Contractor letter of Total Completion;
      - .9 Contractor dated warranty certificate;
      - .10 Completed Electrical Forms, as listed elsewhere in these specification sections or appendix;
      - .11 Other documents that may be requested/ stipulated by the Departmental Representative.
  - .2 Record Drawings
    - .1 Record drawings shall be converted from the original electronic design files, such as CAD, into PDF format.
    - .2 The Contractor shall retain the services of an appropriate supplier to prepare the final record drawings in AutoCAD formats and also converted to PDF format.
    - .3 Draft copies of the record drawings will be submitted at the time of Interim Performance for review by the Departmental Representative. Make corrections to the drawings, as required after the review has been returned.
    - .4 PDF files of the final record drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:

- .1 Drawing number and title,
- .2 Drawing notes,
- .3 Major equipment locations.
- .3 Equipment Data
  - .1 Equipment data shall be classified into the following categories:
    - .1 Equipment submittals.
    - .2 Maintenance data.

#### **1.4 PRINTED COPY MANUALS**

- .1 Organize data in the form of an instructional manual complete with manufacturer's suggested maintenance recommendations and maintenance interval's.
- .2 Binders: slot-lock, screw or wire-bound, hard covered vinyl, with permanent embossed lettering, 219mm x 279mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents,' list title of project and identify subject matter of contents.
- .5 Arrange content by Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide complete and updated, 1:1 Scaled, CAD files in AutoCAD .DWG format on a two (2) CD-R's or removable USB drive with the O&M manuals. Obtain the original .DWG files from the Departmental Representative to make the corrections based on the record information. Bind all x-references to the main drawing file & include all .CTB file plotting & printing information.

#### **1.5 CONTENTS - EACH VOLUME**

- .1 Table of Contents: provide
  - .1 Title of project;
  - .2 Date of submission;
  - .3 Names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
  - .4 Schedule of products and systems, indexed to content of volume;
  - .5 Copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers;
  - .6 All extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification;

- .7 Complete set of all final reviewed shop drawings;
  - .8 Certificates of inspection by Authorities having Jurisdiction;
  - .9 Test reports and certificates as applicable;
  - .10 Complete set of as constructed drawings.
- .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 clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 – Quality Control.
- .6 Training: Refer to Section 01 91 41 – Demonstration and Training.

## **1.6 RECORD DRAWINGS AND SAMPLES**

- .1 In addition to requirements in General Conditions, maintain at the site one (1) record copy of:
- .1 Contract drawings;
  - .2 Specifications;
  - .3 Addenda;
  - .4 Change Orders, Instructions and other modifications to the Contract;
  - .5 Reviewed shop drawings, product data, and samples;
  - .6 Field test records;
  - .7 Inspection certificates;
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Provide an electronic copy of as constructed drawings.

## **1.7 RECORDING ACTUAL SITE CONDITIONS**

- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
  - .1 Field changes of dimension and detail.
  - .2 Changes made by change orders.
  - .3 Details not on original Contract Drawings.
  - .4 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda, Instructions and Change Orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

## **1.8 EQUIPMENT AND SYSTEMS**

- .1 Each item of equipment and each system: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panelboard circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Maintenance Requirements: include routine procedures and checking instructions.
- .5 Include manufacturer's printed operation and maintenance instructions.
- .6 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .7 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .8 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .9 Include test reports as specified in 01 91 13 – Commissioning.
- .10 Additional requirements: As specified in individual specification sections.

**1.9 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 all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

**1.10 MAINTENANCE MATERIALS**

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in the Operating and Maintenance Manuals.
- .5 Obtain receipt for delivered products and submit prior to final payment.

**1.11 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 all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

**1.12 STORAGE, HANDLING AND PROTECTION**

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

**1.13 WARRANTIES AND BONDS**

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible party.

- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.
- .4 Except for items put into use with the facilities permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

**END OF SECTION**

## **1.1 SECTION INCLUDES**

- .1 Includes general requirements for commissioning facilities and facility systems.

## **1.2 DEFINITIONS**

- .1 Acronyms:
  - .1 AFD – Alternate Forms of Delivery, service provider.
  - .2 Cx – Commissioning.
  - .3 O&M – Operation and Maintenance.
  - .4 PI – Product Information.
  - .5 PV – Performance Verification.
  - .6 TAB – Testing, Adjusting and Balancing.
- .2 Cx – a required program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor’s Performance Verification responsibilities have been completed and approved.

## **1.3 QUALITY ASSURANCE**

- .1 Testing organization or Personnel: Organization or personnel is qualified to perform specified services.
- .2 Comply with applicable procedures and standards of the certification sponsoring association.
- .3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

## **1.4 REFERENCES**

- .1 Not Used

## **1.5 SUBMITTALS**

- .1 Prior to start of Work, submit name of organization or person proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
- .2 Submit documentation to confirm organization compliance with quality assurance provision.



- .3 Submit 3 preliminary specimen copies of each of report forms proposed for use.
- .4 Ten (10) days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.
- .5 Submit reports of testing, adjusting and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

#### **1.6 PROCEDURES – GENERAL**

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify Departmental Representative 3 days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report to Departmental Representative any deficiencies or defects noted during performance of services.

#### **1.7 CONTRACTOR'S RESPONSIBILITIES**

- .1 Prepare each system for testing and balancing.
- .2 Cooperate with testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

#### **1.8 PREPARATION**

- .1 Provide instruments required for testing, adjusting, and balancing operations.
- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify equipment are in full operation.

#### **1.9 FINAL REPORTS**

- .1 Organization having managerial responsibility shall make reports.

- .2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

**1.10 COMPLETION OF COMMISSIONING**

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx deliverables have been submitted and accepted by Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1            Section includes:
  - .1            Commissioning forms to be completed for equipment, system and integrated system.

**1.2                INSTALLATION/START-UP CHECK LISTS**

- .1            Include the following data:
  - .1            Product manufacturer's installation instructions and recommended checks.
  - .2            Special procedures as specified in relevant technical sections.
  - .3            Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2            Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3            Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4            Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Operation and Maintenance Manual (O & M) at completion of project.
- .5            Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

**1.3                PRODUCT INFORMATION (PI) REPORT FORMS**

- .1            Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the O & M at completion of work.
- .2            Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

#### **1.4 PERFORMANCE VERIFICATION (PV) FORMS**

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

#### **1.5 SAMPLES OF COMMISSIONING FORMS**

- .1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

#### **1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS**

- .1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
  - .1 Additional commissioning forms to be in same format as provided by Departmental Representative

#### **1.7 COMMISSIONING FORMS**

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
  - .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
  - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
  - .3 Confirm operation as per design criteria and intent.
  - .4 Identify variances between design and operation and reasons for variances.

- .5 Verify operation in specified normal and emergency modes and under specified load conditions.
- .6 Record analytical and substantiating data.
- .7 Verify reported results.
- .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
- .9 Submit immediately after tests are performed.
- .10 Reported results in true measured SI unit values.
- .11 Provide Departmental Representative with originals of completed forms.
- .12 Maintain copy on site during start-up, testing and commissioning period.
- .13 Forms to be both hard copy and electronic format with typed written results.

**1.8 LANGUAGE**

- .1 To suit the language profile of the awarded 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            DESCRIPTION**

- .1        This section specifies demolition and removal of utilities, piping, valves, structures, chambers, and debris.

**1.2            REFERENCES**

- .1        Canadian Council of Ministers of the Environment (CCME)
  - .1        PN 1326-[July 2005], Environmental Code of Practice for aboveground and underground tank systems containing petroleum products and allied petroleum products.
- .2        Canadian Standards Association (CSA International)
  - .1        CSA S350-[M1980(R2003)], Code of Practice for Safety in Demolition of Structures.

**1.3            ADMINISTRATIVE REQUIREMENTS**

- .1        Site Meetings.
  - .1        Convene pre-demolition meeting one week prior to beginning work of this Section to:
    - .1        Verify project requirements.
    - .2        Review installation and substrate conditions.
    - .3        Co-ordination with other subtrades.
    - .4        Review manufacturer's installation instructions and warranty requirements.
  - .2        Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
  - .3        Hold project meetings every week.
  - .4        Ensure key personnel, site supervisor, project manager attend.
  - .5        Departmental Representative will provide written notification of change of meeting schedule established upon contract award 24 hours prior to scheduled meeting.
- .2        Scheduling: meet project time lines without compromising specified minimum rates of material diversion.

- .1 Notify Departmental Representative when unforeseen delays occur.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00.
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
  - .2 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
- .3 Work Execution Plan:
  - .1 Provide description of the method and schedule of various tasks required to complete the work in a manner that unhindered access and use of the facility is guaranteed at all times. Work Execution Plan to be submitted and approved by the Departmental Representative prior to beginning of Work.
- .4 Waste Reduction Workplan:
  - .1 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 19 and indicate:
    - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
    - .2 Schedule of selective demolition.
    - .3 Number and location of dumpsters.
    - .4 Anticipated frequency of tippage.
    - .5 Name and address of haulers, waste facilities, waste receiving organizations.
- .5 Certificates:
  - .1 Submit copies of certified weigh bills, bills of lading, receipts from authorized disposal sites and reuse and recycling facilities for material removed from site on weekly basis upon request of Departmental Representative.
  - .2 Written authorization from Departmental Representative is required to deviate from haulers, facilities, receiving organizations listed in Waste Reduction Work plan.

- .6 Before proceeding with demolition of walls and where required by authority having jurisdiction submit for review by Departmental Representative shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of British Columbia in Canada showing proposed method.

## **1.5 QUALITY ASSURANCE**

- .1 Regulatory Requirements: ensure Work is performed in compliance with applicable Federal, Provincial regulations.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Storage and Protection.
  - .1 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative.
  - .2 Remove and store materials to be salvaged, in manner to prevent damage.
  - .3 Store and protect in accordance with requirements for maximum preservation of material.
  - .4 Handle salvaged materials as new materials.
- .2 Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.
- .3 Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.

## **1.7 SITE CONDITIONS**

- .1 Site Environmental Requirements.
  - .1 Perform work in accordance with Section 01 35 43 – Environmental Procedures.
  - .2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
  - .3 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
    - .1 Ensure proper disposal procedures are maintained throughout the project.



- .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
  - .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
  - .6 Protect trees, plants and foliage on site and adjacent properties where indicated.
  - .7 Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- .2 Existing Conditions.
- .1 Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain; any damaged items shall be repaired or replaced as approved by the Departmental Representative.
  - .2 The contractor shall be liable for damage to improvements and utilities at the worksite. Utilities may exist and not be shown on the construction plans. The site shall be carefully scrutinized for evidence of utilities.
  - .3 The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.
  - .4 Remove contaminated or hazardous materials as defined by authorities having jurisdiction or as directed by Departmental Representative from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner in accordance.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect and Cap Designated Mechanical Services.
  - .1 Underground Services: remove and dispose of as indicated as directed by Departmental Representative.
- .5 Survey Markers and Monuments:
  - .1 Provide three reference points, established by a licensed land surveyor, for each survey marker or monument temporarily removed. Record locations and designations of survey markers and monuments prior to removal.
  - .2 Store removed markers and monuments during demolition work, and replace upon completion of work. Re-establish survey markers and monuments in conformance with recorded reference points. Forward letter to Departmental Representative, signed by a licensed land surveyor, verifying reestablishment of survey markers and monuments.

**3.2 REMOVAL OF HAZARDOUS WASTES**

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

**3.3 REMOVAL OPERATIONS**

- .1 Remove items as indicated upon receiving approval from Departmental Representative.
- .2 Do not disturb items designated to remain in place.
- .3 Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Departmental Representative. When Utility lines are encountered that are not indicated on the drawings, the Departmental Representative shall be notified prior to further work in that area.
- .4 Removal of pavements, curbs and gutters:

- 
- .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
  - .2 Protect adjacent joints and load transfer devices.
  - .3 Protect underlying and adjacent granular materials.
  - .5 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
  - .6 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.
  - .7 Structure Removal, Pipes:
    - .1 This item shall consist of removing the existing pipes on the construction drawings. This includes the complete removal of the pipes.
    - .2 Approximate locations of pipes to be removed are shown on the construction drawings. Actual locations shall be determined during construction operations.
    - .3 Salvage of the materials will be acceptable upon approval of the Departmental representative.
    - .4 Materials not suitable to be buried or salvaged shall be disposed of at an offsite disposal area of the Contractor's own choosing and at the Contractor's own expense in accordance with provincial and local regulations.
    - .5 Plastic and steel pipes must be removed from the site and properly disposed of.
  - .8 Stockpile topsoil for final grading and landscaping:
    - .1 Provide erosion control and seeding if not immediately used.
  - .9 Salvage:
    - .1 Dismantle items containing materials for salvage and stockpile salvaged materials.
  - .10 Disposal of Material:
    - .1 Dispose of materials not designated for salvage at authorized facilities approved in Waste Reduction Workplan.
  - .11 Backfill:
    - .1 Not Applicable

### **3.4 STOCKPILING**

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

### **3.5 REMOVAL FROM SITE**

- .1 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Transport material designated for alternate disposal using approved haulers, facilities, receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
  - .1 Written authorization from Departmental Representative is required to deviate from haulers facilities receiving organizations listed in Waste Reduction Workplan.
- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
  - .1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
  - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

### **3.6 RESTORATION**

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work match condition of adjacent, undisturbed areas.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

### **3.7 CLEANING**

- .1 Progress Cleaning:

- .1 Leave Work area clean at end of each day.
  - .2 Remove debris, trim surfaces and leave work site clean, upon completion of Work
  - .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .3 Waste Management: separate waste materials for reuse recycling.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.8 PROTECTION**

- .1 Repair damage to adjacent materials or property caused by selective site demolition.
- .2 Chemical pollution:
  - .1 The contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to temporarily collect and contain chemical pollutants, such as drained lubricating or transmission fluids, grease, soaps, concrete mixer washwater, or asphalt, produced as a by-product of the construction activities. Pollutants shall be disposed in accordance with appropriate provincial and federal regulations. At the completion of the construction work, sumps shall be removed and the area shall be graded in accordance with the final grading plan. Sump removal shall be conducted without causing pollution.
  - .2 Sanitary facilities, such as chemical toilets, or septic tanks shall not be located next to live streams and water courses. They shall be located at a distance sufficient to prevent contamination of any water source. At the completion of construction activities, facilities shall be disposed of without causing pollution.
- .3 Air pollution:
  - .1 The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.
  - .2 All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be

provided to the contracting representative at least 5 working days before the first application.

.4 Maintenance, removal, and restoration

- .1 All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site shall be graded to achieve the final grade as specified in the construction plans.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Work Included**

- .1 Supply and installation of hangers and supports for all process piping systems or seismic restraints.
- .2 Engage a competent Engineer to be responsible for the final aspects of the piping support system design, including details and spacing of all supports. The support system will ensure that the weight of the pipework and the need for lateral and vertical support are considered fully. Contractor to provide a complete piping system design as described in Drawings.

### **1.2 Submissions**

- .1 Submit the following for information in accordance with Section 01 33 00:
  - .1 In piping layout drawings, indicate hanger and support locations and provide legend summarizing load information and hanger and support component selection at each location.

### **1.3 Service Conditions**

- .1 The intent of the Drawings has been to indicate general arrangements and typical spacings for pipe systems, but does not relieve the Contractor of the responsibility for the design and supply of a complete and adequate support system.
- .2 Provide hangers and supports specified in this Section to resist pipe loads occurring primarily in the downward (gravity) direction. For the purpose of pipe hanger and support selection, this Section established pipe support classifications based on the operating temperature of the piping contents.
- .3 Pipe support classifications:
  - .1 Ambient systems:
    - .1 B-1: 15°C - 49°C.
  - .2 Cold systems:
    - .1 C-1: 0.5°C - 15°C
    - .2 C-2: -40°C - 0°C.

### **1.4 Hanger and Support Selection**

- .1 Piping supports are generally not shown on the process mechanical layout drawings. Therefore, select pipe hangers and supports as specified in this Section. Typical support

details and structural attachments shown on the drawings indicate the level of quality that will be considered acceptable. Where specific supports are illustrated on the process mechanical or structural drawings or where a specific standard detail is noted on the Drawings, provide that type of support for that particular pipeline.

- .2 Review the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the type of support to be used at each hanger point.
- .3 Hangers and supports shall withstand all static and specified dynamic conditions of loading to which the piping and associated equipment may be subjected. As a minimum, consideration shall be given to following conditions:
  - .1 Weights of pipe, valves, fitting, insulating materials, suspended hanger components, and normal fluid contents.
  - .2 Weight of hydrostatic test fluid or cleaning fluid if normal operating fluid contents are lighter.
  - .3 Reaction forces due to the operation of safety or relief valves.
  - .4 Wind, snow or ice loadings on outdoor piping.
- .4 Size hangers and supports to fit the outside diameter of pipe, tubing, or where specified, the outside diameter of insulation.
- .5 Where negligible movement occurs at hanger locations, use rod hangers for suspended lines, whenever practical. Use bases, brackets or structural cross members for piping supported from below.
- .6 Hangers for the suspension of pipe and tubing sizes, 65 mm and larger shall be capable of vertical hanger component adjustment under load.
- .7 Provide the supporting systems to allow for free or intended movement of the piping including its movement in relation to that of connected equipment.
- .8 Design the system to support the operating loads with a safety factor of 4.0.
- .9 Where there is horizontal movement at a suspended type hanger location, select hanger components to allow for swing. The vertical angle of the hanger rod shall not, at any time, exceed 4°.
- .10 No contact is allowed between a pipe and hanger or support components of dissimilar metals. Prevent contact between dissimilar metals when supporting copper tubing with copper-plated, rubber, plastic or vinyl coated, or stainless steel hanger and support components.
- .11 Do not support piping from masonry wall construction.



- .12 Do not use existing pipes and supports to support new piping unless otherwise specified.
- .13 Do not attach pipe support components to equipment or pressure vessels unless otherwise specified.
- .14 Use stock hanger and support components wherever practical.
- .15 Provide supplementary structural members, where structural bearings are not in suitable locations.
  - .1 Make provision for expansion, contraction, slope and anchorage.
  - .2 Where necessary, pipe support systems shall withstand the additional load of electrical or instrumentation trays. Coordinate with other divisions. Design and provide support system accordingly.

**2. PRODUCTS**

**2.1 Acceptable Manufacturers**

- .1 The following Manufacturer's products to provide the specified features and to meet specified operating conditions:
  - .1 B-Line
  - .2 Grinnell
  - .3 Powerstrut
  - .4 Superstrut
  - .5 Unistrut

**2.2 Support Spacing**

- .1 Maximum support spacing shall be as listed in the following table:

Pipe Size Nominal (mm)	Maximum Spacing (m)		
	Iron	Steel or Stainless PVC	Steel
30 and under	2.1	1.4	2.1
30 to 40	2.7	1.5	2.1
40 to 50	3.0	1.6	2.1
60 to 75	3.6	1.8	3.0
100 4.2	2.5	3.7	

150	5.2	3.0	4.3	
200	5.8	3.5	4.6	
250	6.4	4.0	4.9	
300	6.7	4.2	5.2	
350	6.7	-	5.8	
400	6.7	-	6.1	
500	6.7	-	6.7	
600 and greater		6.7	-	6.7

- .2 Provide additional supports at any valves or other heavy piping element.

**2.3 Materials**

- .1 Non-Corrosive Environments (Tunnels and Buildings):

- .1 Unless otherwise specified, pipe hangers and supports, structural attachments, fittings and accessories are hot-dipped galvanized after fabrication.
- .2 Provide cadmium plated hardware (nuts, bolts, washers, threaded rods).
- .3 Touch up cadmium and galvanized material with zinc rich coating where the material has been cut. Exposed bare steel is not acceptable.

- .2 Exterior, Submerged or Corrosive Environments:

- .1 Pipe hangers, supports, structural attachments, fittings, accessories and hardware are all stainless steel.
- .2 Any areas that may be considered corrosive and are in question should be reviewed with the Engineer in advance of securing the materials.

- .3 Provide AISI, Type 304 stainless steel concrete inserts.

**2.4 Pipe Hangers and Supports**

- .1 Type 1 - Clevis Pipe Hanger: Provide carbon steel clevis hangers with configuration and components as follows:

- .1 Steel pipe (insulated) - B-Line B3100, Grinnell Figure 260, Superstrut C-710 or Unistrut No. 24 with insulation shield.
- .2 Steel pipe (uninsulated) - B-Line B3100, Grinnell Figure 260, Superstrut C-710 or Unistrut No. 24.
- .3 Cast and ductile iron pipe - B-Line B3102, Grinnell Figure 590, Superstrut C-710 or Unistrut No. 24.

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- .4 Copper pipe (uninsulated) - shall be B-Line B3104 CT, Grinnell Figure CT-65, Superstrut C-710 or Unistrut No. 51.
  - .5 Copper pipe (insulated) - B-Line B3100, Grinnell Figure 260, Superstrut C-710 or Unistrut No. 24, with insulation shield.
  - .6 Plastic pipe - B-Line B3100, Grinnell Figure 260 or Unistrut No. 56.
  - .2 Type 2 - "J" Pipe Hanger: Provide carbon steel hangers with configuration and components equivalent to MSS Type 5. Use only on uninsulated pipe, with configuration and components as follows:
    - .1 Steel pipe - B-Line B3690, Grinnell Figure 67, Superstrut C-711 or Unistrut J1205-J1280 Series.
    - .2 Copper and plastic pipe - B-Line B3690 (Plasticoat) Grinnell Figure 67 (plastic coated), Superstrut C-711P or Unistrut J 1205N-J1280N series.
  - .3 Type 3 - Double Bolt Pipe Clamp: Provide carbon steel pipe clamps, with configuration and components as follows:
    - .1 Steel pipe (insulated) - B-Line B3144 or Grinnell Figure 295, with insulation shield. Insulation shield is optional for hot and ambient systems.
    - .2 Steel pipe (uninsulated) - B-Line B3144 or Grinnell Figure 295.
    - .3 Copper pipe (insulated only) - B-Line 3144 or Grinnell Figure 295, with insulation shield.
  - .4 Type 4 - Adjustable Roller Hanger: Provide cast iron rollers, carbon steel yoke and cross bolt with configuration and components as follows:
    - .1 Steel pipe (insulated) - B-Line B3110, Grinnell Figure 181 or Superstrut C-729, with insulation shield.
    - .2 Steel pipe (uninsulated) - B-Line B3110, Grinnell Figure 181 or Superstrut C-729.
    - .3 Copper pipe (insulated only) - B-Line B3110, Grinnell Figure 181 or Superstrut C-729, with insulation shield.
    - .4 Plastic pipe - B-Line B3110, Grinnell Figure 181 or Superstrut C-729.
  - .5 Type 5 - Single Pipe Roll: Provide cast iron rollers and sockets, and steel cross rods with configuration and components as follows:
    - .1 Steel pipe (insulated) - B-Line B3114, Grinnell Figure 171 with insulation shield.
    - .2 Steel pipe (uninsulated) - B-Line B3114, Grinnell Figure 171.

- .3 Plastic pipe - B-Line B3114, Grinnell Figure 171.
- .6 Type 6 - Framing Channel Pipe Clamp: Provide steel pipe clamps with hot dipped galvanized finish and material thickness as listed below:
  - .1 Steel pipe (uninsulated) - B-Line 2007, Powerstrut PS1100, or Unistrut P1009 Series:

<b>Pipe Diameter</b> <b>mm</b>	<b>Thickness</b> <b>mm</b>
10 and 12	1.6
20 to 32	2.0
38 to 75	2.8
90 to 125	3.2
150 to 200	3.6

- .2 Steel pipe (insulated); as per 2.4.6.1 with insulation shield.
- .3 Copper (uninsulated) and plastic pipe, B-Line B2033 Series, Powerstrut PS1200 or Unistrut P2024C and P2024PC Series B-Line. Provide a copper-plated, plastic coated or lined with a dielectric material on pipe clamps.

<b>Pipe Diameter</b> <b>mm</b>	<b>Thickness</b> <b>mm</b>
10 to 25	1.6
32 and 38	2.0
50 to 75	2.8
100	3.2

- .4 Copper (insulated); as per 2.4.6.3 with insulation shield.
- .7 Type 7 - U-Bolt: Provide carbon steel U-bolts with configuration as follows:
  - .1 Steel pipe (uninsulated) - Grinnell Figure B-Line B3188 or Superstrut H-115.
  - .2 Steel pipe (insulated) - Grinnell Figure 137, B-Line B3188 or Superstrut H-115 with insulation shield.
  - .3 Cast and ductile iron pipe - Grinnell Figure 137, B-Line B3188 or Superstrut H-115.
  - .4 Copper pipe (uninsulated) - B-Line B3501 CT, Grinnell Figure 137C, Superstrut H-115 (with plastic coating) or Unistrut No. 13 (with plastic coating).
  - .5 Copper pipe (insulated) - Grinnell Figure 137 or B-Line B3188, Superstrut H-115 with insulation shield.
  - .6 Plastic pipe - Grinnell Figure 137C, B-Line B3188 or Superstrut H-115 (with plastic coating).

- .8 Type 8 - Adjustable Pipe Roll Support: Provide cast iron rollers and sockets, and carbon steel cross rod and support rods with configuration and components as follows:
  - .1 Steel pipe (insulated) - B-Line B3122 or Grinnell Figure 177 with insulation shield.
  - .2 Steel pipe (uninsulated) - B-Line B3122 or Grinnell Figure 177.
  - .3 Copper pipe (insulated only) - B-Line B3122 or Grinnell Figure 177 with insulation shield.
  - .4 Plastic pipe - B-Line B3122 or Grinnell Figure 177.
- .9 Type 9 - Welded Pipe Stanchion: Provide a carbon steel, standard schedule pipe stanchion, cut pipe to match contour of pipe elbow. Use only for ambient commodity systems.
- .10 Type 10 - Pipe Stanchion saddle: Provide carbon steel saddles and yokes as follows:
  - .1 Steel pipe (insulated) - B-Line B3900 or Grinnell Figure 259 with insulation shield.
  - .2 Steel pipe (uninsulated) - B-Line 3090 or Grinnell Figure 259.
  - .3 Cast and ductile iron pipe - B-Line 3090 NS or Grinnell Figure 259.
  - .4 Copper pipe (uninsulated) - B-Line B3090 or Grinnell Figure 259 with insulation shield or lined with dielectric material.
  - .5 Copper pipe (insulated) - B-Line B3090 or Grinnell Figure 259 with insulation shield.
  - .6 Plastic pipe - B-Line B3090 or Grinnell Figure 259.
- .11 Type 11 - Offset Pipe Clamp: Provide carbon steel pipe clamps with con-figuration and components as specified and to the most standard design manufactured by a pipe hanger component manufacturer:
  - .1 Steel pipe (insulated) - B-Line B3148 or Grinnell Figure 103 or with insulation shield.
  - .2 Steel pipe (uninsulated) - B-Line B3148 or Grinnell Figure 103.
  - .3 Cast and ductile iron pipe - B-Line B3148 NS or Grinnell Figure 103.
  - .4 Copper pipe (insulated) - B-Line B3148 or Grinnell Figure 103 or with insulation shield.
  - .5 Copper pipe (uninsulated) - B-Line B3148 or Grinnell Figure 103 lined with dielectric material.
  - .6 Plastic pipe - B-Line B3148 or Grinnell Figure 103.
- .12 Type 12 - Riser Clamp: Provide carbon steel riser clamps with configuration and components as follows:

- .1 Steel pipe (insulated) - B-Line B3373 or Grinnell Figure 261, Superstrut C-720 or Unistrut No. 82.
  - .2 Steel pipe (uninsulated) - B-Line B3373 or Grinnell Figure 261, Superstrut C-720 or Unistrut No. 82.
  - .3 Cast and ductile iron pipe - B-Line B3373 or Grinnell Figure 261, Superstrut C-720 or Unistrut No. 82
  - .4 Copper pipe (insulated) - B-Line B3373 CT, Grinnell Figure 261, Superstrut C-720 or Unistrut No. 82.
  - .5 Copper pipe (uninsulated) - B-Line B3373 CT, Grinnell Figure CT-261, Superstrut C-720 or Unistrut No. 84.
  - .6 Plastic pipe - B-Line B3373, Grinnell Figure 261C, or Superstrut C-720 or Unistrut No. 82.
- .13 Type 13 - Framing Channel Pipe Strap: Provide carbon steel pipe strap with configuration as follows:
- .1 Steel pipe (uninsulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series.
  - .2 Steel pipe (insulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series with insulation shield.
  - .3 Copper pipe (uninsulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series with insulation shield.
  - .4 Copper pipe (insulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series with insulation shield.
  - .5 Plastic pipe - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U or Unistrut P2008 Series.
- .14 Rack and Trapeze Supports:
- .1 Unless otherwise specified, provide steel trapeze and pipe rack components having a minimum thickness of 2.8 mm with a maximum deflection 1/240 of the span. Framing channel as specified in 2.4.16.5.
  - .2 Type 20 - Trapeze Pipe Support: Trapeze pipe support cross members as specified in 2.4.16.5. Provide 41 mm<sup>2</sup> carbon steel flat plate fittings of stranded design manufactured by framing channel manufacturer, B-Line B202-2, Powerstrut PS619 or Unistrut P1062 Series.
  - .3 Type 21 - Pipe Rack Support: Post and cross member framing channels, as specified in 2.4.16.5. Provide carbon steel pipe rack fittings of standard design manufactured by

framing channel manufacturer. Provide gusset type, 90° fittings, B-Line B844, Grinnell PS3373 or Unistrut P2484. Post base fittings as specified in 2.4.15.14.

.15 Structural Attachments:

- .1 Type A - Malleable Iron Concrete Insert: Provide malleable iron concrete inserts; B-Line B3014, Grinnell Figure 282 or Unistrut M2808.
- .2 Type B - Side Beam Bracket: Provide malleable iron bracket; Grinnell Figure 202 or B-Line B3062.
- .3 Type C - Malleable Beam Clamp With Extension Piece: Provide malleable iron clamp and extension pieces with steel tie rods; Grinnell Figure 218 with Figure 157 extension piece or B-Line B3054.
- .4 Type D - Steel Beam Clamp With Eye Nut: Provide forged steel beam clamps and eye nuts; Grinnell Figure 292, B-Line B3291 series.
- .5 Type E - Steel channel clamp: Provide malleable iron clamp and heel plates, and steel bolts and nuts; Grinnell Figure 226.
- .6 Type F - Welded Beam Attachment: Provide carbon steel beam attachments; B-Line B3083 or Grinnell Figure 66.
- .7 Type G - Adjustable Beam Attachment: Provide carbon steel beam attachments, B-Line B3082, Unistrut P1737 or Powerstrut PS2648.
- .8 Type H - Double Channel Bracket: Provide single channel attachment as specified in 2.4.16.5. Provide a carbon steel double framing channel cantilever bracket assembly; B-Line B297-12 through B297-36, Powerstrut PS809 or Unistrut P2542 series.
- .9 Type J - Single Channel Bracket: Provide single channel attachment as specified in 2.4.16.5. Provide a carbon steel single framing channel cantilever bracket assembly; B-Line B198-6 through B198-24, Powerstrut PS661 or Unistrut P2231 through P2234.
- .10 Type K - Wall Mounted Channel: Provide 41 mm x 62 mm carbon steel framing channel; B-Line B12 or Unistrut P5500.
- .11 Type L - Pipe Stanchion Attachment: Provide minimum 12 mm thick carbon steel baseplate. Anchor bolt holes: 1.6 mm larger than bolt diameter. Provide non-shrink grout between the baseplate and upstand.
- .12 Type M - Welded Steel Bracket: Provide carbon steel brackets which comply with MSS Type 32 and FEDSPEC Type 33 for medium welded bracket: Grinnell Figure 195. Heavy welded bracket to comply with MSS Type 33 and FEDSPEC Type 34; Grinnell Figure 199.
- .13 Type N - Cast Iron Bracket: Provide cast iron brackets; Grinnell Figure 213.

- .14 Type P - Framing Channel Post Base: Provide carbon steel post bases of stranded design manufactured by framing channel manufacture. Single channel: Unistrut P2072A, B-Line B280 Powerstrut PS3025. Double channel: Unistrut P2073A, B-Line B281 or Powerstrut PS3064.
- .15 Type Q - Continuous Concrete Inserts: Provide 300 mm long carbon steel concrete inserts; Unistrut P3253.
- .16 Accessories:
  - .1 Weldless Eye Nut: Provide forged steel eye nuts and comply with MSS and FEDSPEC Type 17; Grinnell Figure 290 or B-Line B3200.
  - .2 Welded Eye Rod: Provide carbon steel eye rods with eye welded closed. Inside diameter of eye to accommodate a bolt diameter 3.2 mm larger than the rod diameter; Grinnell Figure 278 or B-Line B3211.
  - .3 Turnbuckle: Provide forged steel turnbuckles; Grinnell Figure 230 or B-Line B3202.
  - .4 Framing Channels: Provide 41 mm x 62 mm roll formed carbon steel framed channel, having a thickness of 2.7 mm. Channel to have a continuous slot along one side with in-turned clamping ridges. Single Channel: Unistrut P5500. Double Channel: Unistrut P5501.

## 2.5 Hanger Rods

- .1 Rod material shall conform to ASTM A307 as a minimum, and shall be cadmium plated in non-corrosive interior spaces, stainless steel in exterior, submerged or corrosive applications, threaded on both ends or continuous threaded and sized as specified.
- .2 Hanger rod sizing, as a minimum shall be as follows:

<b>Pipe Size Nominal (mm)</b>	<b>Hanger Rod Diameter (mm)</b>
50	10
75	12
100	16
150	20
200	22
250	25
300	25
400	29
500	38
600	44



**2.6 Base Elbows**

- .1 Where elbows change the run of a horizontal pipe to a vertical direction, supports shall be secured to the elbow.
- .2 Dimensions for the supports shall be as follows:

<b>Pipe Size Nominal (mm)</b>	<b>Support Pipe Diameter (mm)</b>	<b>Base Plate (mm x mm)</b>
100	50 Schedule 40	100 x 6
150	75 Schedule 40	125 x 6
200	100 Schedule 40	150 x 6
250	100 Schedule 40	150 x 6
300	150 Schedule 40	200 x 10
350	200 Schedule 40	250 x 10
400	200 Schedule 40	250 x 10
500	250 Standard Weight	300 x 10
600	300 Standard Weight	350 x 10
750	350 Standard Weight	400 x 10
1050	350 Standard Weight	400 x 10

- .3 Gauge piping: In general, support elbow stanchions for gauge stainless steel piping shall be of the same diameter as the pipe.

**3. EXECUTION**

**3.1 Hanger and Support Location**

- .1 Locate hangers and supports as near as possible to concentrated loads such as valve, flanges, etc. Locate hangers, supports and accessories within the maximum span lengths specified on drawings to support continuous pipeline runs unaffected by concentrated loads.
- .2 Provide hangers and/or base supports within 1 m of each change in direction on each leg, on one side of each valve, and on the first spool piece or fitting extending from a piece of equipment.
- .3 Locate hangers and supports to ensure that connections to equipment, tanks, etc. are substantially free from loads transmitted by the piping.
- .4 Ensure that where piping is connected to equipment, a valve, piping assembly etc. that will require removal for maintenance, the piping will be supported in such a manner that temporary supports will not be necessary for this procedure.

- .5 Support piping so that no pockets will be formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.
- .6 Install spring hangers where required to offset expansion in horizontal runs which follow long vertical risers.

### **3.2 Installation**

- .1 Unless otherwise specified, do not drill or burn holes in the building structural steel.
- .2 Do not use hanger components for purposes other than for which they were designed. Do not use hanger components for rigging and erection purposes.
- .3 Install items to be embedded before concrete is poured. Fasten embedded items securely to prevent movement when concrete is poured.
- .4 Aluminum or galvanized steel clips shall be used to support piping from aluminum or steel structural members. Where metals of different type are to be connected, provide isolation to prevent galvanic corrosion.
- .5 Use embedded anchor bolts instead of concrete inserts for support installation in areas below water surface or normally subjected to submerging.
- .6 Install thermal pipe hanger shields on insulated piping at required locations during hanger and support installation. Butt joint connections to pipe insulation shall be made at the tie of insulation installation in accordance with the manufacturer's recommendation.
- .7 All minor modifications to accommodate installed equipment and structural components are subject to review. Do not commence work on related piping until written acceptance has been received.
- .8 Include any piping support modifications on the shop drawings submitted prior to fabrication or installation.
- .9 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
- .10 Hanger and support components in contact with plastic pipe shall be free of burrs and sharp edges.
- .11 Rollers shall roll freely without binding.
- .12 Finished floor beneath Type L structural attachments and framing channel post bases shall be roughed prior to grouting. Grout between base plate and floor shall be free of void of foreign material.

- .13 Cut and drill baseplates to specified dimensions prior to welding stanchions or other attachments and prior to setting anchor bolts.
- .14 Provide plastic or rubber end caps at the exposed ends of all framing channels that are located up to 2100 mm above the floor.
- .15 Review the drawings prior to installation of piping, conduit, and fixtures by this or any other division. Identify any conflicts and confirm the routing of each section of pipe work prior to commencement of installation. Advise of any conflicts with existing services. Where necessary, amend the routing of pipework to avoid conflict and provide shop drawings showing proposed routing.

### **3.3 Adjustment**

- .1 Adjust hangers and supports to obtain required pipe slope and elevation. Use shims made of material that is compatible with the piping material. Adjust stanchions prior to grouting of baseplates.

### **3.4 Underslab Piping**

- .1 The Mechanical and General contractors are to note that long term settlement is expected to varying degrees below most of the structural slabs and tanks.
- .2 Below grade piping, and construction methods used to prevent future pipe breakage, will be impacted as follows:
  - .1 In general, it is preferred that piping below grade proceed without the use of pipe hangers, and that a settlement allowance be added to or subtracted from the pipe grading to accommodate expected settlement. A general rule of thumb is to assume settlement equal to 1% of the depth of fill placed and compacted below the pipe. Unexcavated soil (virgin ground) beneath new structures will not settle significantly however fills placed in either the pregrading contract or in this contract can be expected to settle as described above.
  - .2 Care must be exercised where pipes in fill areas enter or leave structures, due to the creation of hard points at the penetration. Piping that elbows up to extend vertically through structural slabs cast on fills should be separated from the slab using a good bond break, with the incorporation of stress relief elbows or free horizontal pipe lengths prior to the first above grade support point.

**END OF SECTION**

## **1. GENERAL**

### **1.1 Description**

- .1 This Section specifies the supply, installation and testing of process valves used for isolation, flow throttling, and bypass.

### **1.2 Definitions**

- .1 Valve Identification
  - .1 Valves are identified in the Drawings by valve symbols. Refer to the Drawings for lists of valve symbols and labels.
- .2 Detailed Valve Specification Sheets:
  - .1 Detailed valve specification sheets are provided in Section 23 31 15 for each type of valve identified in the process mechanical Drawings.
  - .2 Where there is a conflict between valves described in this Section and other valves described in Contract Documents, conform to the more stringent requirements.

### **1.3 Submittals**

- .1 Shop Drawings: Submit the following information in accordance with Section 01 33 00:
  - .1 Catalog cuts and/or shop Drawings for each type of valve indicating the valve number, materials of construction, dimensions, head loss characteristics through the valve, operating torque and valve end configuration.
  - .2 An amended Detailed Valve Specification Sheet for all valves. Indicate with check marks where the valve supplied meets the requirements specified and with written amendments where the product differs from the specification.
- .2 Operating and Maintenance data for incorporation in Operation and Maintenance Manual, as specified in Section 01 33 00. Include complete description of operation together with detailed Drawings, a complete list of replacement and repair parts, and parts Manufacturer's identifying numbers.
- .3 Affidavits and registration numbers described below in Quality Assurance.

### **1.4 Quality Assurance**

- .1 Provide affidavits of compliance, as required by AWWA C500 for gate valves.
- .2 For butterfly valves to be installed below ground, provide affidavits of compliance with AWWA C504.

- .3 Valves are to be marked in accordance with MSS SP-25.

## **1.5 Shipment, Protection and Storage**

- .1 Deliver valves to site in accordance loading methods which do not damage casings or coatings.
- .2 Clearly tag valves stating size, type, coatings and mating parts.
- .3 Store on-site until ready for incorporation in the Work using methods recommended by the manufacturer to prevent damage, undue stresses, or weathering.

## **2. PRODUCTS**

### **2.1 General**

- .1 Provide valves of the same type, size range and service from a single manufacturer.
- .2 Provide new, unused valves for the Work.
- .3 Valve materials to be free from defects or flaws, with true alignment and bores.
- .4 Unless otherwise indicated, valves shall be the same size as the pipe run in which they are to be installed.
- .5 Clearly mark valve bodies in raised lettering to indicate the valve type, rating, and where applicable, the direction of flow. Conform to MSS SP25.
- .6 Provide padlockable lockout feature on all sizes of the following valve types.
- .7 Valves to open counter-clockwise.

### **2.2 Valve Ends**

- .1 In pipe runs less than 75 mm diameter provide valves with female threaded ends, unless indicated otherwise. Threads to conform to ANSI B1.20.1.
- .2 Valves in pipe runs equal to or greater than 75 mm diameter to be flanged unless indicated otherwise.
- .3 For cast iron body valves, drill flanges to Class 125 pattern conforming to ANSI B16.1. For steel body valves, flanges to be Class 150 pattern or Class 300 pattern conforming to ANSI B16.5.
- .4 Do not use grooved joint valve ends.
- .5 Use flanged joints for buried and exterior valves. The flanges are to be compatible with the pipe and jointing technique used.

- .6 Use flanged joints for buried butterfly valves.
- .7 Lug style wafer body valves shall have tapped holes, suitable for the bolt spacing of the pipe flanges placed on either side.
- .8 Wafer body valves shall have positioning holes, suitable for the bolt spacing of the pipe flanges placed on either side.
- .9 Use wafer body butterfly valves only for control applications, and only if other valve(s) are provided for blocking and isolation. Use lug style or flanged wafer body butterfly valves if the function is blocking and isolation, including control valves where separate block and isolation valves are not provided.
- .10 For gate valves, end flanges shall be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1, Class 125 flanges.

### **2.3 Manual Operators**

- .1 Provide valves with manual operators unless specifically indicated otherwise on the process schematic Drawings or mechanical Drawings.
- .2 For hand wheels, clearly show the direction of opening in raised lettering and symbols.
- .3 Hand wheel diameter to conform to the following:

Nominal Valve Diameter (mm)	Minimum Hand Wheel Diameter (mm)
12	50
20	50
25	60
38	75
50	85
65	105
75	200
100	250
150	300
200	350
250	400
300	450
350	450
400	550
450	600
500	600
600 and up	600

- .4 The maximum rim pull on a hand wheel not to exceed 300 N when one side of the valve is at test pressure and the other side is at atmospheric pressure. Where a shaft mounted hand wheel would require greater than this force to operate, provide a gear operator. Unless different operators are scheduled or shown in the Drawings, conform to the following minimum requirements:
- .1 Gate Valves: less than 300 mm, hand wheel; equal to or greater than 300 mm, gear operator.
  - .2 Knife Gate Valves: less than 300 mm, hand wheel; equal to or greater than 300 mm, gear operator.
  - .3 Globe and Needle Valves: less than 200 mm, hand wheel; equal to or greater than 200 mm, gear operator.
- .5 Match existing operating nuts. Provide  $\frac{2}{8}$  point operating wrenches.
- .6 Supply stem extensions and valve boxes for buried valves and stem extensions for submerged valves as specified in the Drawings and in Clause 2.5 of this Section.
- .7 Provide two operating tees.
- .8 Lever operators to conform to the following dimensions:

<b>Nominal Valve Diameter (mm)</b>	<b>Minimum Length of Lever (mm)</b>
6	80
12	80
20	100
38	150
50	150
65	150
75	175
100	225
150	250
200	300
250	450
300	450

- .9 Quarter turn lever operators to be perpendicular to the pipe run when the valve is closed.
- .10 Lever operators on ball valves to be two position. Provide butterfly valves with ten (10) position latching levers except where used to balance air flows. Where used to balance air flows provide infinite position, screw down levers.
- .11 The maximum pull at the end of the lever arm not to exceed 300 N when one side of the valve is at test pressure and one side is at atmospheric pressure. Where greater than this force would be required to operate the valve with a lever, provide a gear operator. Unless different operators are scheduled or shown in the Drawings, conform to the following minimum requirements:
  - .1 Ball Valves: less than 150 mm, lever operator; greater than or equal to 150 mm, gear operator.
  - .2 Butterfly Valves: less than 250 mm, lever operator; greater than or equal to 250 mm, gear operator.
- .12 Gear operator to be worm gear type, equipped with a hand wheel and a visual indicator of the valve position. Equip operators with adjustable mechanical stop-limiting devices to prevent over-travel of the disc/ball in the open and closed positions and which are self-locking and designed to hold the valve in any intermediate position between full open and full closed. Gear operators shall be grease lubricated.
- .13 Operators for exposed service shall be gasketed for weatherproof service. Place gear boxes above ground and liquid surfaces.
- .14 For manual valves on lines 75 mm and greater, mounted over 2.0 m above the operating floor, provide chain wheel gear operators. Design the operator so that a force of 150N is sufficient to open the valve when one side of the valve is at test pressure and the other side



is at atmospheric pressure. The chain pulley to mesh positively with the chain. Extend the chain from the valve operator to operating height 1.2 m above the floor or as directed by the Department Representative. The exact dimensions shall be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.

## **2.4 Stem and Couplings**

- .1 Provide operating stems and couplings of stainless steel.
- .2 Provide the stem with a slenderness ratio (L/R) less than 200.
- .3 Hollow stems are acceptable but they must be provided with stem guides (mounting brackets) and thrust bearings designed to carry the weight of the stem extension, eliminate load on the stem, and prevent buckling.
- .4 Machine cut the threaded portion of the stem.
- .5 For stems in more than one piece and with a diameter of 44.5 mm and larger, join the different sections together by threaded and bolted connections.
- .6 Groove and key the couplings. The couplings are to be of greater strength than the stem.
- .7 Provide stem guides of stainless steel, type 304 and UHMWPE bushed.

## **2.5 Valve Stem Extensions**

- .1 Provide valve stem extensions where additional clearance is required for pipe insulation, for all submerged or buried valves and other locations where valve operation without the extension is difficult, and in manholes.
- .2 Where angle valve stem extensions are employed, they shall be angle geared. Universal joint types are not permitted.
- .3 For all valves equal to or greater than 150 mm requiring stem extensions, provide pedestal mounted operators as shown on the process mechanical Drawings and standard details.

## **2.6 Valve Boxes**

- .1 Provide valve boxes for all buried valves as per the Drawings and standard details.

## **2.7 Insulation**

- .1 Insulate valves as specified on drawings.
- .2 Preform insulation in a shape suitable for the valve, of the same material specified for piping.

- .3 Recovering to be as specified for piping, with transition sections for the joints between the valve insulation and the pipe insulation.
- .4 Insulation to be removable and reusable without destroying insulation or recovering.

## **2.8 Pressure (Self) Regulating Valves**

- .1 Pressure (self) regulation (PRV) valves shall be supplied, installed and calibrated under this Division.

## **2.9 Protective Coatings**

- .1 Unless otherwise specified, provide valves epoxy coated.

## **3. EXECUTION**

### **3.1 Preparation**

- .1 The valve and piping arrangement indicated in the Drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in the piping to allow for discrepancies between the valve dimensions shown and those supplied for the Work.
- .2 Prior to the installation of the valves, field measure and check all equipment locations, pipe alignments, and structural installation. Ensure that the valve location and orientation provides suitable access to manual operators and that sufficient space and accessibility is available for pneumatic and electric actuators.
- .3 Where conflicts are identified, inform the Department Representative and initiate the necessary piping modifications at no cost to the Owner.

### **3.2 Valve Installation**

- .1 In horizontal pipe runs other than in locations where space does not permit, mount all valves except for butterfly valves and trunnion ball valves with a vertical operating shaft with the actuator at the top. Avoid installing install a valve with the operator shaft pointing down.
- .2 Mount butterfly valves and trunnion ball valves with the shaft in a horizontal orientation unless impractical.
- .3 Mount valves in a position for easy access to the operators and maintenance personnel.
- .4 When joining valves to pipe or fittings, do not over torque bolts to correct for misalignment.
- .5 Support valves in position using temporary supports until valves are fixed in place.

- .6 Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.
- .7 Where valves are installed in PVC pipework greater than 100 mm diameter, support valves independently and brace against operating loads and torque to prevent transmission of stresses to the adjacent pipework.
- .8 Generally pipe supports and hangers are not shown unless for indication purposes only.
- .9 Install gate valves in the closed position.
- .10 Install valves which are bubble tight in one direction to seal in a direction opposite to normal flow unless otherwise noted or directed by the Department Representative.
- .11 Unless otherwise specified, install single seated ball valves and knife gate valves with the seat downstream. Install at tank connections with seat away from tank. Install on pump discharge and suction lines with seat adjacent to the pump.
- .12 Install all valves in accordance with the manufacturer's recommendations.
- .13 Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tapewrap.
- .14 Insert wafer and lug wafer butterfly valves between the flanges in the closed position, align and bolt finger-tight. Then open the valve fully before torquing the bolts. Test that the disk does not catch the edge of the flange on closing and opening.

### **3.3 Valve Extensions**

- .1 Install valve stem extensions where necessary to provide clearance from insulation.

### **3.4 Insulation**

- .1 Install insulation and recovering as indicated on the Drawings.

### **3.5 Valve Testing**

- .1 Ensure that the position indicated by the lever or actuator matches the actual position of the valve.
- .2 Operate valves under simulated and/or real process conditions to ensure they operate as intended.
- .3 Pressure test the valves in conjunction with the pipes in which the valves are installed.

**END OF SECTION**

**PART 1**      **GENERAL**

**1.1**            **RELATED SECTIONS**

- .1      Section 01 33 00.
- .2      Section 01 74 19.
- .3      Section 01 78 00.

**1.2**            **REFERENCES**

- .1      Aluminum Association (AA)
  - .1      AAI DAF45, Designation System for Aluminum Finishes.
- .2      Canadian General Standards Board (CGSB)
  - .1      CGSB 41-GP-6M, Sheets, Thermosetting Polyester Plastics, Glass Fibre Reinforced.
- .3      Canadian Standards Association (CSA)
  - .1      CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
  - .2      CSA W59.2, Welded Aluminum Construction (Metal Arc Welding).
- .4      The Master Painters Institute (MPI)
  - .1      Architectural Painting Specification Manual.

**1.3**            **SUBMITTALS**

- .1      Submit representative sample of each type of sign, sign image and mounting method, including, but not limited to graphic, cast letters, sign box installation method, channel letters and wall plates fixed mounting installation method.
- .2      Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
- .3      Submit drawn-to-scale details for individually fabricated or incised lettering indicating word and letter spacing.
- .4      Submit representative sample of each type sign, sign image and mounting method.
- .5      Submit manufacturer's printed product literature panel signage or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .6      Submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

**1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for illuminated signs for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

**1.5 QUALITY ASSURANCE**

- .1 Welding Certification in accordance with CSA W47.2.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Aluminum extrusions: to AA 6063-T5 or AA 6006-T5.
- .2 Sheet aluminum: utility quality.
- .3 Prefinished sheet aluminum: plain utility sheet with manufacturer applied baked enamel finish 0.25 mm thick on face and 0.0076 mm thick on back.
- .4 Casting aluminum: CSA HA Series - HA.9-SG7ON-T6.
- .5 Acrylic sheet: polymethylmethacrylate (PMMA) cast sheet suitable for intended use in sign fabrication, colours as indicated.
- .6 Engraving sheet: lamicoid 3.2 mm thick plastic sheet, white core.
- .7 Self-stick foam tape: 1.6 mm thick, 352.4 kg/m<sup>3</sup> density polyurethane open-cell foam tape for sign purposes, with synthetic self-stick adhesive on both sides. Width: to suit sign sizes.
- .8 Adhesives, paints, sealants and solvents for acrylic sheet: type recommended by sheet manufacturer for applicable condition.
- .9 Acrylic top-coat: clear, non-yellowing, exterior grade, satin finish, acrylic polyester resin protective coating, compatible with acrylic surface of type recommended by sheet manufacturer.
- .10 Bituminous paint: to CAN/CGSB-1.108, type 2.

**2.2 SIGN GRAPHICS**

- .1 Sign graphics to be well defined, arranged for balanced appearance, and properly word and letter spaced.
- .2 Cut and spray process: mask surfaces, accurately cut-out image, then spray apply uniform coating to obtain opaque finish.

- .3 Silk screen process: apply multi-colour photographic produced silk screen printed images to back side of transparent sign faces; face side of opaque sign faces.
- .4 Engraving: apply sign images using pantograph mechanical engraving machine to obtain incised letters as detailed or specified.
- .5 Self-stick vinyl film: individual letters and numerals and symbols die cut from 0.1 mm thick black integral colour, matte finish, exterior grade PVC film, with self-stick adhesive backing.
- .6 Decals: silk screened or printed images on 0.038 mm, clear matte finish, mylar film, with self-stick adhesive backing. Protect image with laminated film overlay of same material as decal base.

### **2.3 CUT-OUT LETTERS**

- .1 Cut letters and symbols from coloured acrylic.
- .2 Helvetica typeface, upper and lower case; sizes and thicknesses as indicated. Make corners square cut.

### **2.4 WALL PLATES**

- .1 Plastic wall plates:
  - .1 Fabricate from colour acrylic sheet 3.2 mm. Sizes as indicated.
  - .2 Sign graphics: apply by engraving.
- .2 Metal wall plates:
  - .1 Fabricate from sheet aluminum sign plates, minimum 3.2 mm thick, with colour anodized finish. Sizes as indicated.
  - .2 Sign graphics: apply by engraving.
- .3 Cast Aluminum Letters: (exterior):
  - .1 Supply and install cast aluminum letters 250 mm high in upper case Helvetica Bold. Lettering to read “name of Building”, Finish color to be as selected by Owner’s Representative.
- .4 Interchangeable mounting: supply wall plates with approved type, semi-concealed, retaining holders that permit quick but vandal-resistant interchange of sign face. No exposed fasteners permitted. Exposed portions to match sign face.
- .5 Fixed mounting: prepare wall plates for fixing by surface fasteners with rosette covers. Include back-up plates for fixing to uneven surfaces where required.
- .6 Bracket mounting: fabricate brackets for wall projecting or ceiling suspended sign plates as detailed: of clear acrylic 4.8 mm thick.

## **2.5 DOOR PLATES**

- .1 Fabricate sign faces of color acrylic sheet. Sizes as indicated.
- .2 Sign graphics: apply by engraving, with 25 mm high letters. Signs to be mounted on outside of doors.
- .3 Interchangeable mounting: supply door plates with approved type, semi-concealed, retaining holders that permit quick but vandal-resistant interchange of sign face. No exposed fasteners permitted. Exposed portions to match sign face.
- .4 Fixed mounting: use self-stick foam tape.
- .5 Mounting on transparent surfaces: use self-stick foam tape. Include blank back-up plate for opposite side.
- .6 Washroom pictographs: cut-out figures without backgrounds.

## **2.6 NUMBER PLATES**

- .1 Fabricate number plates for doors of engraving sheet. Size as indicated.
- .2 Engrave 9.5 mm high, single line numerals incised to expose contrasting coloured core.

## **2.7 GENERAL FABRICATION REQUIREMENTS**

- .1 Fabricate signs in accordance with details, specifications and shop drawings.
- .2 Build units square, true, accurate to size, free from visual or performance defects.
- .3 Accurately fit and securely join sections to obtain tight, closed joints.
- .4 Allow for thermal movement without distortion of components.
- .5 Exposed fasteners permitted only where indicated or approved by Owner's Representative and to be inconspicuous and same finish and colour as base material, or as noted.
- .6 Polish exposed edges of plastic and metal to smooth, slightly convex profile.
- .7 Apply bituminous paint to aluminum in contact with dissimilar metals, concrete or masonry.
- .8 Manufacturer's nameplates on sign surface locations visible in completed work not acceptable.

**PART 3**      **EXECUTION**

**3.1**            **INSTALLATION**

- .1      Erect and secure signs plumb and level at elevations indicated.
- .2      Comply with sign manufacturer's installation instructions and approved shop drawings.
- .3      Mechanical attachment:
  - .1      To concrete or solid masonry use lag screws and expansion bolts or screws and fibre plugs, as appropriate for stresses involved.
  - .2      To hollow masonry use toggle bolts or equivalent.
  - .3      To steel use bolts with nut and lock washers, self-tapping screws, welding, as appropriate for stresses and metal thicknesses.
  - .4      To wood use screws.
  - .5      Secure into framing members behind stud walls or above ceilings.
  - .6      Mechanical fasteners on exterior to be non-staining, non-ferrous type.
  - .7      Fabricate special fasteners as required for installation conditions.
  - .8      Mechanical fasteners and methods of attachment subject to Owner's Representative approval. Obtain Owner's Representative approval before fixing to structural steel.
- .4      Adhesive attachment:
  - .1      Use self-stick adhesive foam tape to manufacturer's instructions to adequately fix sign and prevent "rocking". Keep tape maximum 1.6 mm from edges.

**3.2**            **CLEANING**

- .1      Leave signs clean. Remove debris from interior of sign boxes.
- .2      Touch up any damaged finishes.

**3.3**            **COMMISSIONING**

- .1      Instruct Owner on care and cleaning.

**END OF SECTION**



## PART 1 - GENERAL

### 1.01 DESCRIPTION:

- A. This section includes materials and installation of markers, labels, and signs for pipes, ducts, and valves; for mechanical equipment; for hazardous materials warnings.
  - 1. Section includes:
    - a. Underground type plastic line markers.
    - b. Warning signs and labels.
    - c. Pipe labels.
    - d. Stencils.
    - e. Valve tags.
    - f. Warning tags.
    - g. Piping system color coding schedule.
  - 2. Identification furnished as part of equipment is specified as part of equipment assembly in other sections and shall comply with requirements of this section.

### 1.02 REFERENCES:

- A. American Society of Mechanical Engineers (ASME):
  - 1. A13.1: Scheme for the Identification of Piping Systems
- B. American Society of Testing and Materials (ASTM):
  - 1. D709: Standard Specification for Laminated Thermosetting Materials

### 1.03 SUBMITTALS:

- A. Submit the following shop drawings in accordance with Section 01 33 00.
  - 1. Product Data: For each type of product indicated.
  - 2. Samples: For color, letter style, and graphic representation required for each identification material and device.

3. Shop Drawings:

- a. Submit valve schedule for each piping system, typewritten and produced on 8-1/2 inches by 11 inches bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves intended for emergency shut-off and similar special uses, by special flags in schedule margin. In addition to mounted copies, furnish extra copies for maintenance manuals.

1.04 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 yrs.
- B. Regulatory Requirements:
  1. ANSI Standards: Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.05 MAINTENANCE:

- A. Extra Materials:
  1. Furnish minimum 5 percent extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
    - a. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock along with required stock of stenciling paints and applicators.

1.06 COORDINATION:

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS:

- A. Allen Systems, Inc.
- B. Brady (W.H.) Company, Signmark Division.
- C. Marking Services, Inc.
- D. Industrial Safety Supply Company, Inc.
- E. Seton Name Plate Corporation.Or acceptable equivalent product.

### 2.02 MECHANICAL IDENTIFICATION MATERIALS:

- A. Provide manufacturer's recommended products as specified for each application.
- B. Where more than single type is specified for application, selection is installer's option, but provide single selection for each product category.
- C. Bands, markers, and identification materials used in process locations shall be rated for exterior application and suitable for withstanding occasional wash down.

### 2.03 EQUIPMENT LABELS:

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Stainless steel, **0.025-inch** (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  - 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1.6 mm (1/16 inch)** thick, and having predrilled holes for attachment hardware.
2. Background Color and Letter Color: As identified in Schedule 10 14 10.
3. Maximum Temperature: Able to withstand temperatures up to 71 degrees C.
4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 inch by 11 inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

F. Label and band colors in accordance with ASME A13.1, Pipe Identification Schedule 10 14 13-2 and following:

1. Lettering and arrows as identified in Schedule 10 14 13-2, or as follows:
  - a. Black on yellow background for inherently hazardous materials.
  - b. White on blue (gaseous) or green (liquid) for low hazard materials.
  - c. White on red background for fire quenching materials.
2. Banding: Colors and band spacing are presented in Schedule 10 14 13-2.

2.04 PAINTED DUCTWORK IDENTIFICATION:

A. Stencils: Standard fiberboard stencils prepared for required applications with letter sizes generally complying with recommendations of ASME A13.1 for piping and

similar applications, but not less than 1-1/4 inches high letters for ductwork and not less than 3/4-inch high letters for access door signs and similar operational instructions.

B. Stencil Paint: Standard exterior type stenciling enamel, black except as otherwise indicated; either brushing grade or pressurized spray can form and grade.

C. Nomenclature: Include following:

1. Direction of air flow (arrow).
2. Duct service (supply, return, exhaust, etc.).
3. Hazardous Exhausts: List duct origin (chlorine room, fume hood, wet well, etc.).

#### 2.05 PLASTIC DUCTWORK MARKERS:

A. Provide manufacturer's standard laminated plastic, color coded, adhesive duct markers. Conform to the color code as identified in Schedule 10 14 13-2, or as follows:

1. Black letters on white background for non-hazardous areas.
2. For hazardous exhausts, use black letters on yellow background.

B. Nomenclature: Include following:

1. Direction of air flow (arrow).
2. Duct service (supply, return, exhaust, etc.).
3. Hazardous Exhausts: List duct origin (chlorine room, fume hood, wet well, etc.).

#### 2.06 UNDERGROUND TYPE PLASTIC LINE MARKERS:

A. Permanent, bright colored, continuous printed plastic tape, intended for direct burial service; not less than 6 inches wide by 4 mils thick. Provide tape with printing most accurately indicating type of service of buried pipe.

B. Provide multi-ply tape consisting of solid aluminum foil core between 2 layers of plastic tape.

#### 2.07 WARNING SIGNS AND LABELS:

A. Engraving stock melamine plastic laminate complying with ASTM D709 in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, white with black core (letter color) except as otherwise indicated,

punched for mechanical fastening except where adhesive mounting necessary because of substrate.

- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
- C. Letter Color: As identified in Schedule 10 14 13-2.
- D. Background Color: As identified in Schedule 10 14 13-2.
- E. Maximum Temperature: Able to withstand temperatures up to 160 degrees F (71 degrees C).
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- G. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless-steel.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information, plus emergency notification instructions.

#### 2.08 PIPE LABELS:

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

#### 2.09 STENCILS:

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
  1. Stencil Material: Aluminum.
  2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

#### 2.10 VALVE TAGS:

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
  1. Tag Material: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
- B. Valve Schedules: For each piping system, on 8-1/2 inch by 11 inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  1. Valve-tag schedule shall be included in operation and maintenance data.

#### 2.11 WARNING TAGS:

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum
  2. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

3. Color: Yellow background with black lettering.

### PART 3 - EXECUTION

#### 3.01 PREPARATION:

- A. Coordination: Where identification are to be applied to surfaces requiring insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

#### 3.02 PIPING SYSTEM IDENTIFICATION:

- A. Locate pipe markers with arrows and color bands as follows wherever piping exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exterior non-concealed locations.
  1. Near each valve and control device.
  2. Near locations where pipes pass through walls or floors, ceilings or enter non-accessible enclosures.
  3. At access doors, manholes, and similar access points permitting view of concealed piping.
  4. Near major equipment items and other points of origination and termination.
  5. Spaced intermediately at maximum spacing of 30 feet along each piping run, except reduce spacing to 20 feet in congested areas of piping and equipment.
  6. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- B. Locate color bands at each marker and at intermediate spacing not to exceed 10 feet between bands, and at lesser spacing as indicated or as required by local codes.
- C. Locate directional arrows at each marker. Provide 2 arrows at each tee or branch fitting.
- D. Where piping is normally visible from more than 1 side, provide 2 or 3 labels and arrows spaced at 120 degree intervals around pipe in accordance with ASME A13.1.



3.03 DUCTWORK IDENTIFICATION:

- A. Identify air supply, return, exhaust, intake and relief ductwork with duct markers and direction of flow arrows in black or white (whichever provides most contrast with ductwork color).
- B. Location: In each space where ductwork is exposed or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 30 foot spacings along exposed runs. Provide 2 flow arrows at each branch or tee fitting.
- C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings indicating purpose of access (to what equipment).

3.04 UNDERGROUND PIPING IDENTIFICATION:

- A. During backfilling/top soil placement of each exterior underground piping systems, install continuous underground type plastic line marker located directly over buried line at 6 to 8 inches below finished grade. Where multiple small lines buried in common trench and do not exceed overall width of 16 inches, install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

3.05 PLUMBING AND HVAC VALVE IDENTIFICATION:

- A. Provide valve tag on each plumbing and HVAC valve, cock, and flow control device in each piping system. Exclude check valves, valves within factory fabricated equipment units, plumbing fixture faucets, convenience and lawn watering hose bibs, shut-off valves at plumbing fixtures, HVAC terminal devices, and similar rough-in connections of end use fixtures and units.
- B. Schedule:
  - 1. List each tagged valve in valve schedule for each piping system.
  - 2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where indicated by Departmental Representative.
    - a. Where more than one major machine room shown for project, install mounted valve schedule in each major machine room and repeat only main valves operated in conjunction with operations of more than single machine room.
  - 3. For each page of valve schedule, provide glazed display frame with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum with SSB grade sheet glass.

3.06 PROCESS VALVE IDENTIFICATION:

- A. Install engraved plastic marker or fiberglass tag at each process valve, gate, or flow control device as identified by P&ID tag numbers on Drawings.

3.07 MECHANICAL EQUIPMENT IDENTIFICATION:

- A. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, if not otherwise specified for each item or device. Provide signs for each unit having equipment tag number on Drawings or in Specifications.
- B. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.08 EQUIPMENT LABEL INSTALLATION:

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.09 PIPE LABEL INSTALLATION:

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

### 3.10 VALVE-TAG INSTALLATION:

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  1. Valve-Tag Size and Shape:
    - a. Cold Water: [1-1/2 inches (38 mm) square.
    - b. Hot Water: 1-1/2 inches (38 mm) square.
    - c. Low-Pressure Compressed Air: 1-1/2 inches (38 mm) square.
    - d. High-Pressure Compressed Air: 1-1/2 inches (38 mm) square.
  2. Valve-Tag Color:
    - a. Cold Water: As identified in Schedule 10 14 13-2.
    - b. Hot Water: As identified in Schedule 10 14 13-2.
    - c. Low-Pressure Compressed Air: As identified in Schedule 10 14 13-2.
    - d. High-Pressure Compressed Air: As identified in Schedule 10 14 13-2.
  3. Letter Color:
    - a. Cold Water: As identified in Schedule 10 14 13-2.
    - b. Hot Water: As identified in Schedule 10 14 13-2.
    - c. Low-Pressure Compressed Air: As identified in Schedule 10 14 13-2.

d. High-Pressure Compressed Air: As identified in Schedule 10 14 13-2.

3.11 WARNING-TAG INSTALLATION:

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.12 ADJUSTING AND CLEANING:

- A. Adjusting: Relocate any mechanical identification device visually blocked.
- B. Cleaning: Clean face of identification devices and glass frames of valve schedules.

3.13 FIELD QUALITY ASSURANCE:

- A. Final Survey and Repairs:
  - 1. 1 year after date of substantial completion, Contractor shall perform walk-through survey of mechanical identification systems and shall remove and replace any bands, labels, tags or markers that are loose, discolored, or defective.
  - 2. Replacement materials shall be provided by Contractor, not drawn from Owner's extra material.

3.14 CONTRACT CLOSEOUT:

- A. Provide in accordance with Section 01 78 00.

3.15 SCHEDULES:

<b>Schedule 10 14 13-1</b>		
<b>Outside Pipe Diameter (in.)</b>	<b>Minimum Letter Height (in.)</b>	<b>Minimum Length of Marker (in.)</b>
3/4 to 1-1/4	1/2	8
1-1/2 to 2	3/4	8
2-1/2 to 6	1-1/4	12
8 to 10	2-1/2	24
over 10	3-1/2	32

<b>Schedule 10 14 13-2</b>				
<b>Piping Identification Schedule</b>				
<b>Flowstream Identifier</b>	<b>Background Label Color</b>	<b>Duct/Pipe Label Text</b>	<b>Duct/Pipe Color</b>	<b>Duct/Pipe Banding</b>
<b><i>WATER</i></b>				
(Hot) (Soft)	Green	Potable Water Non-Potable Water	Light Blue Dark Blue	--- Yellow
<b><i>DRAINS &amp; WASTE</i></b>				
(UD)(BD)(D)(PD) ---	Yellow Green	Sanitary Drain Roof Drain	Dark Gray (Match wall color)	--- ---
<b><i>OTHER</i></b>				
	Yellow	Other Lines	Light Gray	

**END OF SECTION**

**1. GENERAL**

**1.1 Work Included**

- .1 The valve specification sheets on the following pages detail the valves which are to be supplied, installed, and tested as part of the Work.

**2. PRODUCTS**

**2.1 Specification**

- .1 Page 2 to 6 following.

<b>GENERAL:</b>						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Reduced Pressure Backflow Prevention Valve (RPBP)		Domestic & Fire Water Supply	800	0-40	1206	40
<b>TYPICAL SERVICE:</b>						
Backflow preventer to provide protection of safe drinking water in accordance with national plumbing codes and water utility requirements, including high hazard cross connections and/or containment in service line entrance.						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		REFERENCE DOCUMENT			
Body	Cast Bronze C84400 or C89836		SIZE RANGE		50 to 200 mm	
Bolts	Stainless Steel		RATING			
Check Valve Cartridge	Glass Filled PPO		BODY/VALVE ENDS			
Spring	300 Series Stainless Steel		PATTERN			
Seat Discs	Chloramine Resistant Silicone		OPERATOR			
O-Rings	Chloramine-Resistant EPDM		ACTUATOR			
Check Springs	Stainless Steel		LINING			
			COATING			

<b>NOTES:</b>		
1. Leak before press technology		
2. Ball Valves SS handles and nuts		
3. Modular relief valve		
4. Approval by cross-connection and hydraulic research at Uni. Of Southern California		
<b>ACCEPTABLE PRODUCTS</b>		
Apollo	Fabco	Watts

<b>GENERAL:</b>						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Ball Valve		Domestic & Fire Water Supply	800	0-40	1000	40

**TYPICAL SERVICE:**  
 Isolation valve for Domestic Water, Fire Water and Drain lines.

VALVE MATERIALS		VALVE DESCRIPTION	
ITEM	MATERIAL	REFERENCE DOCUMENT	
Body	Stainless Steel	SIZE RANGE	Body Material - ASTM A351 6 mm to 100 mm
Ball	316 Stainless Steel / 304 Stainless Steel	RATING	Class 150
Packing	Reinforced	BODY/VALVE ENDS	Flanges >65 mm Female Threaded ≤65 mm
Seats	Reinforced TFE	PATTERN	Full Port
Shaft	316 Stainless Steel (Note 1)	OPERATOR	
		ACTUATOR	
		LINING	
		COATING	

<b>NOTES:</b>	
1. Blowout proof stem	
2. Complete with adapters.	

ACCEPTABLE PRODUCTS		
KITZ	Nibco	Jenkins
Grinnell	Trueline	Watts

GENERAL:						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Resilient Seat Gate Valve		Domestic & Fire Water Supply	500	0-40	1380	40

**TYPICAL SERVICE:**

On/Off valve on straight through line for buried service.

VALVE MATERIALS		VALVE DESCRIPTION	
ITEM	MATERIAL	REFERENCE DOCUMENT	
Body	Cast Iron, ASTM A126, Class B	SIZE RANGE	AWWA C509 200 – 300
Disc		RATING	ANSI B16.1, Class 125
Disc Trim		BODY/VALVE ENDS	Push-on
Seats		PATTERN	
Shaft		OPERATOR	
Trim		ACTUATOR	To CRD Standards
		LINING	Epoxy Coated
		COATING	Epoxy Coated

**NOTES:**

1.

ACCEPTABLE PRODUCTS		
Clow	AVK	Mueller



<b>GENERAL:</b>						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Butterfly Valve		Domestic & Fire Water Supply	500	0-40	1000	40
<b>TYPICAL SERVICE:</b>						
On/Off valve on straight through line.						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL		REFERENCE DOCUMENT			
Body	Cast Iron, ASTM A126, Class B		<b>SIZE RANGE</b>		100 mm to	
Disc	See Note 1				600 mm	
Disc Trim	See Note 1		<b>RATING</b>		ANSI B16.1, Class 125	
Seats	EPDM		<b>BODY/VALVE ENDS</b>		Flanges	
Shaft	304 Stainless Steel		<b>PATTERN</b>			
Trim	Bronze		<b>OPERATOR</b>			
			<b>ACTUATOR</b>		Manual (handwheel) or As Per Specification with Chain Operator	
			<b>LINING</b>		Epoxy Coated	
			<b>COATING</b>		Epoxy Coated	
<b>NOTES:</b>						
1. Bronze or ductile iron disc with bronze, nickel, or chrome trim. Full bronze disc for valves below 200 mm.						
2. The valve body shall be a short body construction.						
3. Submerged valves shall be epoxy-coated.						
4. Where the isolation valves are installed at more than 1.8 m above finished floor, provide chain wheel operator						
<b>ACCEPTABLE PRODUCTS</b>						
Keystone Pratt		Mueller Bray		DeZurick		

<b>GENERAL:</b>						
TYPE OF VALVE	SYMBOL	TYPE OF COMMODITY	OPERATING LIMITS		DESIGN LIMITS	
			PRESSURE (kPag)	TEMP. (°C)	PRESSURE (kPag)	TEMP. (°C)
Flush Type Hydrant		Fire Water Supply	1732	0-40	3447	40
<b>TYPICAL SERVICE:</b>						
On/Off valve on straight through line.						
VALVE MATERIALS			VALVE DESCRIPTION			
ITEM	MATERIAL	REFERENCE DOCUMENT				
Body	Ductile Iron	SIZE RANGE		133 mm		
Hydrant Box/Cover	Cast Iron ASTM A-126 Class B					
Nozzle Section	Cast Iron ASTM A-126, Class B	Hose Nozzle		63.5 mm		
Operating Nut	Eco Brass Alloy C87850	BODY/VALVE ENDS		Flanges		
Main Valve Rod	Steel C1117 HFS	PATTERN				
Lower Valve Plate/ Bottom Plate	Cast Iron ASTM A-126 Class B	OPERATOR		Operating Nut with Key		
		ACTUATOR		NA		
		LINING		Epoxy Coated		
		COATING		Epoxy Coated		
<b>NOTES:</b>						
<b>ACCEPTABLE PRODUCTS</b>						
M & H Valve Mueller						

**END OF SECTION**

Approved: 2012-06-30

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1    Section 23 05 80.
- .2    Section 23 11 00.
- .3    Section 23 14 10.
- .4    Section 23 14 13.
- .5    Section 23 31 15.

**1.2                PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1    Not Applicable

**1.3                MEASUREMENT PROCEDURES**

- .1    Measure Domestic Water main, in metres of each size of pipe installed.
  - .1    Horizontal measurement will be made over surface, through valves and fittings, after work has been completed.
  - .2    Measure lateral connections from water main to hydrants as Domestic Water main and include curb valve and adjustable valve box.
- .2    Measure tunnelling, boring or jacking for under crossings, including encasing pipes and grouting, in metres, as indicated.
- .3    Measure hydrants including excavation and backfilling, in units installed.
- .4    Measure float connections, in metres of each size of pipe installed.
- .5    Measure valves in units installed.

**1.4                REFERENCES**

- .1    American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1    ANSI/AWWA B300-[10], Standard for Hypochlorites.
  - .2    ANSI/AWWA B301-[10], Standard for Liquid Chlorine.
  - .3    ANSI/AWWA B303-[10], Standard for Sodium Chlorite.
  - .4    ANSI/AWWA C104/A21.4-[08], Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  - .5    ANSI/AWWA C105/A21.5-[10], Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - .6    ANSI/AWWA C111/A21.11-[07], American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
  - .7    ANSI/AWWA C110/A21.10-[08], American National Standard for Ductile-Iron and Gray Iron Fittings for Water.

- .8 ANSI/AWWA C150/A21.50-[08], Standard for Thickness Design of Ductile-Iron Pipe.
  - .9 ANSI/AWWA C151/A21.51-[09], Standard for Ductile-Iron Pipe, Centrifugally Cast.
  - .10 ANSI/AWWA C153/A21.53-[11], Standard for Ductile-Iron Compact Fittings.
  - .11 ANSI/AWWA C200-[05], Standard for Steel Water Pipe - 6 Inch (150 mm) and Larger.
  - .12 ANSI/AWWA C203-[08], Standard for Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
  - .13 ANSI/AWWA C205-[07], Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100 mm) and Larger - Shop Applied.
  - .14 ANSI/AWWA C206-[11], Standard for Field Welding of Steel Water Pipe.
  - .15 ANSI/AWWA C207-[07], Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
  - .16 ANSI/AWWA C208-[07], Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
  - .17 ANSI/AWWA C300-[11], Standard for Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
  - .18 ANSI/AWWA C301-[07], Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
  - .19 ANSI/AWWA C303-[08], Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
  - .20 ANSI/AWWA C500-[09], Standard for Metal-Seated Gate Valves for Water Supply Service.
  - .21 ANSI/AWWA C504-[10], Standard for Rubber-Seated Butterfly Valves.
  - .22 ANSI/AWWA C600-[10], Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.
  - .23 ANSI/AWWA C602-[11], Standard for Cement-Mortar Lining of Water Pipelines - 4 Inch (100 mm) and Larger.
  - .24 ANSI/AWWA C651-[05], Standard for Disinfecting Water Mains.
  - .25 ANSI/AWWA C800-[05], Standard for Underground Service Line Valves and Fittings.
  - .26 ANSI/AWWA C900-[07], Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 ASTM International
- .1 ASTM A53/A53M-[10], Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
  - .2 ASTM A123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .3 ASTM A307-[10], Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

- .4 ASTM B88M-[05(2011)], Standard Specification for Seamless Copper Water Tube [Metric].
- .5 ASTM C117-[04], Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .6 ASTM C136-[06], Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .7 ASTM C478M-[11], Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].
- .8 ASTM D698-[07e1], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .9 ASTM D2310-[06], Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- .10 ASTM D2657-[07], Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
- .11 ASTM D2992-[06], Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
- .12 ASTM D2996-[01(2007)e1], Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- .13 ASTM F714-[10], Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .14 ASTM C618-[08a], Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .3 American Water Works Association (AWWA)/Manual of Practice
  - .1 AWWA M9-[2008], Concrete Pressure Pipe.
  - .2 AWWA M11-[2004], Steel Pipe - A Guide for Design and Installation.
  - .3 AWWA M17-[2006], Installation, Field Testing, and Maintenance of Fire Hydrants.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
  - .3 CAN/CGSB-34.1-[94], Pipe, Asbestos Cement, Pressure.
  - .4 CGSB 41-GP-25M-[77], Pipe, Polyethylene, for the Transport of Liquids.
- .5 CSA International
  - .1 CAN/CSA-A257 Series-[09], Standards for Concrete Pipe (Consists of A257.0, A257.1, A257.2, A257.3 and A257.4).
  - .2 CAN/CSA-A3000-[08], Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .3 CAN/CSA-B137 Series-[09], 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 CAN/CSA-B137.1-[09], Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
- .2 CAN/CSA-B137.3-[09], Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .4 CSA G30.18-[09], Carbon and Steel Bars for Concrete Reinforcement.
- .6 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual latest edition.
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S520-[07], Standard for Fire Hydrants.
  - .2 CAN/ULC-S543-[09], Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.

### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Pipe certification to be on pipe.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
  - .2 Submit complete drawings include method for installation of Domestic Water main.
- .4 Samples:
  - .1 Not Applicable

### **1.6 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.
  - .1 Include top of pipe, horizontal location of fittings and type, valves, and hydrants.
- .3 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, and hydrants for incorporation into manual.

### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect water distribution piping from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**1.8 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 24 hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 hours unless otherwise authorized.
- .5 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .6 Provide and post "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

**1.9 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Tools: provide tools as follows:
  - .1 Hydrant wrenches.
  - .2 Tee-handle operating keys for valves
  - .3 Required spare parts for 2 year period.

**Part 2 Products**

**2.1 PIPE, JOINTS AND FITTINGS**

- .1 All Domestic Water piping shall be Black HDPE DR 11 rated.

Item	Size	Description
General	All	Pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier except for expansion joints and valves where SS 316 flanges shall be provided c/w SS 316 hardware.  Materials in contact with potable water shall conform to NSF 61 acceptance.

Item	Size	Description																
Pipe	All	<p>ASTM D3350, high density polyethylene, maximum allowable hoop stress 5.5 MPa (800 psi) at 23 °C.</p> <p>Polyethylene resins shall conform to Type PE 3408 or better.</p> <p>Protection shall be provided against ultraviolet light degradation using carbon black, not less than 2 percent well dispersed in the resin.</p> <p>Pipe wall thickness shall reflect the required SDR* and diameter, as shown in Table 8, ASTM F714.</p> <p>Design Stress Rating: ASTM F714, 5.5 MPa (800 psi) hydrostatic.</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Pressure Rating</th> <th>SDR*</th> </tr> </thead> <tbody> <tr> <td>200</td> <td>9</td> </tr> <tr> <td>160</td> <td>11</td> </tr> <tr> <td>130</td> <td>13.5</td> </tr> <tr> <td>100</td> <td>17</td> </tr> <tr> <td>80</td> <td>21</td> </tr> <tr> <td>65</td> <td>26</td> </tr> <tr> <td>50</td> <td>32.5</td> </tr> </tbody> </table> <p>* SDR: standard dimension ratio = OD/thickness</p>	Pressure Rating	SDR*	200	9	160	11	130	13.5	100	17	80	21	65	26	50	32.5
Pressure Rating	SDR*																	
200	9																	
160	11																	
130	13.5																	
100	17																	
80	21																	
65	26																	
50	32.5																	
Fittings	150 mm & smaller	Molded fittings, butt fusion joined, conforming to ASTM D3261.																
Flanges	All	Van Stone type, cast ASTM A351/A351M, Type 316 stainless steel backing ring, IPP Deltaflex convoluted design or equal for bolting to ASME B16.1, Class 125; ASME B16.5, Class 150; and AWWA C207, Class E. Pressure performance of the backing ring equal to SDR rating of the pipe with safety factor of two. Stub ends same grade HDPE and pressure rating as pipe.																
Expansion Joints	All	Proco Style 261R-EE Molded Wide Arch Expansion Joints c/w 150 lb SS 316 flanges and backing rings or approved equal																
Bolting	All	<p>General Conditions: Stainless Steel hardware.</p> <p>Washers shall be same material as bolts.</p>																
Gaskets	All	Flat ring, 3 mm ethylene propylene rubber (EPR).																

## 2.2 FLEXIBLE HOSE

- .1 Provide smooth, white, phthalate free, taste free food quality synthetic rubber complete with reinforcement: High-tensile steel wire helix embedded between layers of synthetic textile cords. The cover on the hose shall be blue, wrapped finish, ozone and weather resistant synthetic rubber.
  - .1 Temperature Range: -30°C (-22°F) to 100°C (212°F).
  - .2 Pressure rating: 150 psi or more.
  - .3 Design Standard: Greenline Model G1041 or approved equal



### **2.3 FLUSH TYPE FIRE HYDRANT AND HOSE**

- .1 Provide ULC listed and NFPA 14 approved fire protection system components.
- .2 Fire Hydrant to be Valve Flush Type and shall comply, where applicable, to AWWA Standard C-502, latest revision. Flush Type Fire Hydrants shall be of the compression type, with the main valve opening against the pressure and closing with the pressure. The main valve opening shall be 5 ¼" diameter. Flush Type Fire Hydrants shall be of a dry barrel design.
- .3 Flush Type Fire Hydrants shall be rated at 150 psi water working pressure, tested at 300 pounds hydrostatic for structural soundness in the following manner; 300 pound hydrostatic test supplied from the inlet side, first with the main valve closed for the testing of the valve seat; second, with the main valve open for testing of the drain valves and the hydrant barrel. Clockwise or counter clockwise as comparable with existing fire hydrants on site.
- .4 Hydrants shall be connected to the main by a 6" mechanical joint or flanged shoe. Mechanical joint shoes shall be fitted with strapping lugs.
- .5 Hose Rack: ULC listed, swivel type with pins to permit hose to be hung in folds stationary-type rack with pins designed for 180 degrees movement. Locking device shall prevent flow of water into hose until last fold is removed from rack. Complete with hose, nozzle and angle valve.
- .6 Hose: ULC listed, 2.5 inches nominal diameter, 100 ft long, synthetic jacket, synthetic rubber lined.
- .7 Nozzle: ULC listed, 2.5 inches nominal diameter, forged brass adjustable combination fog-straight stream with shut-off.

### **2.4 PIPE PROTECTION**

- .1 Provide means of protection for piping in traffic and walking areas.
- .2 Provide 2 channel rubber polymer ramps suitable for minimum 44 ton loading. Secure ramps as per manufacturer's recommendations.

### **2.5 VALVES AND VALVE BOXES**

- .1 Refer to Section 23 31 15.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PREPARATION**

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
  - .1 Inspect materials for defects to approval of Departmental Representative.
  - .2 Remove defective materials from site as directed by Departmental Representative.

### **3.3 PIPE INSTALLATION**

- .1 Lay pipes to [ANSI/AWWA C600] [ANSI/AWWA [M-9] [M-11]] manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- .2 Join pipes in accordance with AWWA C901, C906 and manufacturer's recommendations.
- .3 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .4 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
  - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .5 Position and join pipes with equipment and methods approved by Departmental Representative.
- .6 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .7 Align pipes before jointing.
- .8 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .9 Avoid displacing gasket or contaminating with dirt or other foreign material.
  - .1 Remove disturbed or contaminated gaskets.
  - .2 Clean, lubricate and replace before jointing is attempted again.
- .10 Complete each joint before laying next length of pipe.
- .11 Minimize deflection after joint has been made.
- .12 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

### **3.4 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.

### **3.5 HYDRANTS**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA M17.

- .3 Install gate valve and cast iron valve box on hydrant service leads as indicated.
- .4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
- .5 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
- .6 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level [150] mm above drain holes.
- .7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

### **3.6 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Do tests in accordance with ANSI/AWWA C600.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative at least 24 hours in advance of proposed tests.
  - .1 Perform tests in presence of Departmental Representative.
- .4 Leave hydrants, valves, joints and fittings exposed.
- .5 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .7 Open valves.
- .8 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .9 Thoroughly examine exposed parts and correct for leakage as necessary.
- .10 Apply hydrostatic test pressure of 1378 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.
- .11 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .12 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .13 Repeat hydrostatic test until defects have been corrected.
- .14 Define leakage as amount of water supplied from water storage tank metre in order to maintain test pressure for 2 hours.
- .15 No leakage is allowed.

- .16 Locate and repair defects if leakage is greater than amount specified.
- .17 Repeat test until leakage is within specified allowance for full length of water main.

**3.7 HYDRANT FLOW TESTS**

- .1 Conduct flow tests on every hydrant to determine fire flows prior to painting hydrant caps and ports.

**3.8 PAINTING OF HYDRANTS**

- .1 After installation, paint hydrants red.
- .2 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

**3.9 FLUSHING AND DISINFECTING**

- .1 Flushing and disinfecting operations: witnessed by Departmental Representative.
  - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains to the requirements of local authority.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.
- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
  - .1 Take samples daily for minimum of 2 days.

- .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .3 Contractor to submit certified copy of test results.
- .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

**3.10 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**