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**DRAWING LIST**

| Drawing No. | Drawing Title | Revision |
|---|---|---|
| CT-00 | Cover Sheet | 0 |
| CT-01 | Civil – Plan / Profile | 0 |
| CT-02 | Civil – Standard Details | 0 |
| E-01 | Electrical – Heat Trace Plan | 0 |

**END OF SECTION**

**SUMMARY OF WORK**

## 1. GENERAL

### 1.1 Description of Work

.1 The Work to be performed under this Contract shall include the labour, equipment, and materials required to complete the construction of Watermain Replacement Project, which includes water supply piping with heat tracing, water service piping with heat tracing, pressure sewer service piping with heat tracing, connections to existing infrastructure, electrification, and site restoration.

.2 The Work includes, but is not limited to the following elements:

.1 The replacement of approximately 160 m of existing 150 mm water supply line with new 150 mm pre-insulated, heat traced, high-density polyethylene (HDPE) water supply line and removal/abandonment of existing 38 mm water return line.

.2 The replacement of approximately 40 m of existing 50 mm water service supply line with a new 25 mm heat traced, HDPE CARAPACE water service supply line (supplied by others) inside a new 75 mm pre-insulated, HDPE DR17 carrier pipe and removal/abandonment of existing 50 mm water service return line.

.3 The replacement of approximately 40 m of existing 50 mm pressure sewer service line with new 32 mm heat traced, HDPE CARAPACE pressure sewer service line (supplied by others) inside a new 75 mm pre-insulated, HDPE DR17 carrier pipe.

.4 Installation of electric power supply cables to supply the heat trace system.

.5 Connection of the new heat trace system to existing electrical panels in the VRC and Multi purpose buildings.

.6 Site restoration from construction activity.

.7 Coordinate installation training for the equipment.

.8 Coordinate operation and maintenance training for the equipment.

.9 Supply all required operation and maintenance manuals.

.10 Supply Record Drawings.

### 1.2 Contract Method

.1 Construct Work under single stipulated price.

### 1.3 Completion

.1 The Contractor shall achieve Substantial Performance of the work no later than October 15, 2020.

.2 The Contractor shall achieve Completion of the work no later than October 31, 2020.

### 1.4 Work Sequence

.1 Construct Work in stages to accommodate Canada’s intermittent use of premises during construction.

.2 Co-ordinate progress schedule and co-ordinate with owner occupancy during construction.

**1.5 Contractor Use of Premises**

.1 Limit use of premises for Work, for storage, and for access, to allow:

.1 Owner occupancy.

.2 Co-ordinate use of premises under direction of Department Representative.

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

.4 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

**1.6 Owner Occupancy**

.1 Canada will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Canada in scheduling operations to minimize conflict and to facilitate tenant's usage.

**2. PRODUCTS (NOT USED)**

**3. EXECUTION (NOT USED)**

**END OF SECTION**

**WORK RESTRICTIONS**

## 1. GENERAL

### 1.1 Use of Site and Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

### 1.2 Existing Services

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

.2 Provide for pedestrian and vehicular traffic.

### 1.3 Security

.1 Make arrangements with local staff for access on a daily basis. When hours of works extend beyond normal business hours, make arrangements with local staff for site lock-up.

### 1.4 Building Smoking Environment

.1 Comply with smoking restrictions. Smoking is not permitted.

### 1.5 Cooperation with Others

.1 The Contractor’s attention is directed to the fact that other Contractors, the personnel of other utilities and the staff of other agencies may be working in the areas on or adjoining the site.

.2 The activities of these agencies may coincide with the Contractor’s execution of the work, and it will be the Contractor’s responsibility to cooperate to the fullest extent with personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of this Contract.

### 1.6 Hours of Operation

.1 Hours of operation for excavation works and hauling within the community shall be 7:00 a.m. to 9:00 p.m., unless permitted otherwise by Canada.

### 1.7 Traffic Control and Maintenance of Access

.1 It will be the responsibility of the Contractor under the Contract to maintain traffic during the entire period of the Contract and to ensure that maximum protection is afforded to the road user and that the Contractor's operations in no way interfere with the safe operation of traffic.

.2 Where deemed necessary by the Department Representative, a temporary access roadway shall be provided by the Contractor for any residence or building that does not have an alternate means of vehicular access. The access roadway shall also be maintained, removed and the site thoroughly cleaned up on completion by the Contractor. The cost of this work shall be borne by the Contractor.

.3 The Contractor shall supply, erect and maintain all applicable traffic control devices in accordance with the provisions contained in the latest edition of the Uniform Traffic Control Devices for Canada, (UTCD), distributed by The Transportation Association of Canada.

.4 The Contractor shall provide and maintain flagmen in accordance with the above-mentioned manual.

.5 The Contractor shall take all other safety measures necessary to cope with any peculiar or unusual circumstances which have not been set out in the above-mentioned manual.

.6 During the hours when the Contractor is not working, equipment and stockpiled material shall be left in such a location so as not to interfere with or present a hazard to motorists or pedestrians.

.7 Refer to Section 33 10 00 for restrictions related to work in the vicinity of the Hudson Bay Railway track.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**MOBILIZATION AND DEMOBILIZATION**

## 1. GENERAL

### 1.1 Description

.1 The work specified in this section comprises the provision of all labour, equipment and materials, and the performance of all work necessary for mobilization to and demobilization from the site, insurance and bonding requirements and camp.

.2 Mobilization shall include transportation to the site of the Contractor's labour, equipment and materials in readiness to start the work.

.3 Demobilization shall include the dismantling and removal from the site of all of the Contractor's equipment and materials and cleanup of the site.

.4 Camp shall include the Contractor’s cost for providing room and board.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

# PAYMENT PROCEDURES

## 1. GENERAL

### 1.1 Applications for Progress Payment

.1 Make applications for payment on account monthly as Work progresses.

### 1.2 Schedule of Values

.1 Provide schedule of values supported by evidence as Department Representative may reasonably direct and when accepted by Department Representative, be used as basis for applications for payment.

.2 Include statement based on schedule of values with each application for payment.

## 2. PRODUCTS

### 2.1 Not Used

.1 Not Used.

## 3. EXECUTION

### 3.1 Not Used

.1 Not Used.

**END OF SECTION**

**PROJECT MEETINGS**

## 1. GENERAL

### 1.1 Administrative

.1 Schedule and administer project meetings throughout the progress of the work at the call of Department Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Department Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within five business days after meetings and transmit to meeting participants, affected parties not in attendance, and Departmental Representative.

.8 Representatives of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

### 1.2 Preconstruction Meeting

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 4 business days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work.

.3 Schedule of submission of shop drawings.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.

.5 Site security.

.6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.7 Record drawings.

.8 Monthly progress claims, administrative procedures, photographs, hold backs.

.9 Appointment of inspection and testing agencies or firms.

.10 Insurances, transcript of policies.

**1.3 Progress Meetings**

.1 During course of Work, schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative, are to be in attendance.

.3 Notify parties minimum 4 business days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 business days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

# CONSTRUCTION PHOTOGRAPHS

## 1. GENERAL

### 1.1 Construction Photographs

.1 Provide construction photographs in accordance with procedures and requirements specified in this Section.

### 1.2 Progress Photographs

.1 Electronic on CD or flash drive.

.2 Identification: date of exposure in upper right-hand corner.

.3 Minimum thirty-six photographs per month. Locations to be as directed by the Department Representative.

.4 Frequency: monthly with progress statement.

### 1.3 Final Photographs

.1 Electronic on CD or flash drive.

.2 Identification: date of exposure in upper right-hand corner.

.3 Minimum two hundred photographs. Locations to be as directed by the Department Representative.

### 1.4 Preconstruction Photographs

.1 Electronic on CD or flash drive.

.2 Identification: date of exposure and location.

.3 Photos to portray the condition of all buildings, roads, yards, and surface features in the community prior to the commencement of construction.

### 1.5 Electronic Files

.1 Submit all electronic files of prints noted above.

.2 Supply files on CD or flash drive and identify with name and number of project.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**SUBMITTALS**

## 1. GENERAL

### 1.1 Drawings

.1 The Contractor shall review, stamp with his approval and submit, with reasonable promptness and in orderly sequence so as to cause no delay in the work or any Other Contractor, all Shop Drawings and samples required by the Contract Documents or requested by the Department Representative. Shop Drawings and samples shall be properly identified as specified or as the Department Representative may require. At the time of submission, the Contractor shall inform the Department Representative in writing of any deviation in the Shop Drawings or samples from the requirements of the Contract Documents.

.2 By approving and submitting Shop Drawings and samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and co-ordinated each Shop Drawing and sample with the requirements of the Work and of the Contract Documents.

.3 The Department Representative will review the Shop Drawings and samples with reasonable promptness, but only for general conformance with the design concept of the Project and with the information given in the Contract Documents. The Department Representative's review of a separate item shall not indicate approval of such item or of any assembly in which the item functions.

.4 The Contractor shall make any corrections required by the Department Representative and shall resubmit the required number of corrected copies of Shop Drawings or new samples. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Department Representative on previous submissions.

.5 The Department Representative's review of Shop Drawings or samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Department Representative in writing of such deviation at the time of submission and the Department Representative has given written approval to the specific deviation; the Department Representative's review and such approval shall not relieve the Contractor from responsibility for errors or omissions in the Shop Drawings or samples.

.6 No portion of the Work requiring a Shop Drawing or sample submission shall be commenced until the submission has been reviewed by the Department Representative as herein provided. Arrange for the preparation of clearly labelled shop drawings as called for in the specifications or as the Department Representative may request. Shop drawings are to clearly indicate dimensions, operating clearance, performance characteristics, capabilities, materials, method of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop drawings are to indicate their relationship to design drawings and specifications. Notify the Department Representative in writing of any deviations in shop drawings from the requirements of the Contract Documents. The information furnished on shop drawings shall be in S.I. metric units only.

.7 Allow a period for review of drawings by the Department Representative of one (1) week for individual drawings and two (2) weeks for large sets of drawings plus any further time for re-submission and review of amended drawings.

.8 Submit one (1) digital copy of shop drawings in pdf form and product data for review by the Department Representative.

Shop drawing submittals by Facsimile is prohibited.

.9 Shop drawing review by the Department Representative is for the sole purpose of ascertaining that the information set forth therein generally conforms with the design concept for the work.

.10 Responsibility for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and coordination of all parts of the Work rests with the Contractor.

.11 Shop drawings will be returned to the Contractor with one (1) of the following notations:

.1 When stamped "REVIEWED NO COMMENT" or “REVIEW BY DEPARTMENT REPRESENTATIVE NOT REQUIRED” distribute additional copies as required for execution of the Works.

.2 When stamped "REVIEWED AS NOTED", ensure that all copies for use are modified and distributed.

.3 When stamped “REVIEWED REVISE AND RESUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.

.4 When stamped "NOT REVIEWED" or "REJECTED", submit other Drawings, brochures, etc. for review consistent with the Contract Documents.

.5 Only Shop Drawings bearing "REVIEWED NO COMMENT", “REVIEW BY DEPARTMENT REPRESENTATIVE NOT REQUIRED”, “REVIEWED AS NOTED”, shall be used on the Works unless otherwise authorized by the Department Representative.

.6 After submittals are stamped "REVIEWED NO COMMENT", “REVIEW BY DEPARTMENT REPRESENTATIVE NOT REQUIRED”, “REVIEWED AS NOTED”, no further revisions are permitted unless re-submitted to the Department Representative for further review.

.7 Any adjustments made on Shop Drawings by the Department Representative are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of work.

.8 Make changes in Shop Drawings, which the Department Representative may require, consistent with Contract Documents. When re-submitting, notify the Department Representative in writing of any revisions other than those requested by the Department Representative.

.9 Shop Drawings indicating design requirements not included in the Contract Documents require the seal of a qualified Professional Engineer. Consulting calculations shall be submitted for review, if requested, and sealed by a qualified Professional Engineer.

.10 Only two (2) reviews of Shop Drawings will be made by the Department Representative at no cost. Each additional review will be charged to the Contractor at the Department Representative's scheduled rates. The Department Representative's charges for the additional work will be deducted from the Contractor's Progress Certificates. Any adjustments made on shop drawings by the Department Representative are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of the work.

.12 Fabrication of products shall not commence until shop drawings have been reviewed by the Department Representative and found not to require re-submission.

.13 Shop drawings indicating design requirements not included in the Contract Documents require the seal of a Professional Engineer, registered in the province of Manitoba. Engineering calculations must be submitted for review, if requested, and must be signed by a Professional Engineer.

.14 Submit drawings of all pressure vessels to the Manitoba Boilers Branch for approval. Ensure vessels are approved prior to installation.

.15 All submittals shall be labelled as follows:

**Parks Canada Agency**
**VRC Watermain Replacement Project**

If resubmission, indication required as to second or third, etc. The Department Representative assigned submission number shall be shown by the Contractor on each resubmission.

Submission (first or second, etc.) _____

Submission Number _____

Number of Copies Submitted _____

Index Page of Submission _____

Specification Sections and
Clause Number Reference _____

Page Number on Each Component
of Submission _____

The Department Representative will return all improperly identified submissions for correction before review.

## 1.2 Samples

.1 Submit for the Department Representative's review standard manufacturer's samples as called for in the specifications or as the Department Representative may reasonably request. Clearly label samples as to origin and intended use in Work. Reference samples to drawings and specifications.

.2 Submit samples with reasonable promptness and in orderly sequence, so as to cause no delay in Work. Failure to submit samples in ample time is not to be considered sufficient reason for an extension of Contract Period and no claim for extension by reason of such default will be allowed. If requested, the Department Representative may jointly prepare a schedule fixing the dates for submission.

.3 Notify the Department Representative in writing, at time of submission, of any deviations in samples from requirements of Contract Documents.

.4 The Department Representative will review samples in accordance with schedule agreed upon or otherwise with reasonable promptness so as to cause no delay in Work. The Department Representative's review will be for conformity of design concept and general arrangement only. Such review is not to be considered relief of responsibility for errors or omissions in samples or of responsibility for meeting all requirements of the Contract Documents.

.5 Any adjustments made on samples by the Department Representative are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with the use of the material in the Work.

.6 Make changes in samples which the Department Representative may require consistent with Contract Documents.

.7 Do not order material until results of Department Representative's review have been received.

## 1.3 Operating and Maintenance Data

.1 Provide operating and maintenance manuals as per Section 01 78 23.

## 1.4 Record Drawings

.1 After award of Contract, the Department Representative will provide two (2) complete sets of drawings for the purpose of maintaining "record" drawings. Accurately and legibly record all deviations from Contract Documents caused by site conditions and changes agreed with or ordered by the Department Representative, on a continuing basis.

.2 Record locations of concealed elements of mechanical and electrical services and all other components which may be concealed.

.3 Record all conduit and cable runs complete with size, routing and wire count.

.4 Identify drawings as "Project Record Copy". Maintain in good condition and make available for inspection on site by the Department Representative at all times.

.5 Not less than four (4) weeks prior to application for the Final Certificate of Completion, submit record drawings to the Department Representative for review.

### 1.5 Interference Drawings

.1 Before installation of structural, mechanical and electrical systems, prepare an integrated set of interference drawings in cooperation with all trades.

.2 Drawings shall show locations and relationship of all trades in mechanical equipment rooms, electrical equipment rooms, pipe spaces, tunnels, galleries and basements. Drawings shall show electrical conduits and pipes to be cast into structural slabs, walls and columns.

.3 As the work progresses, prepare and submit updated interference drawings.

.4 After reviewing with the Department Representative, make all necessary relocations due to interference of trades as a result of incomplete drawings, at no additional cost.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**HEALTH AND SAFETY REQUIREMENTS**

## 1. GENERAL

### 1.1 General

.1 The Contractor shall be responsible for the safety of all persons and property on or about the project and for ensuring that the work is performed in accordance with all applicable safety requirements.

.2 Without in any way limiting the generality of the foregoing, the Contractor shall comply fully with the following provisions:

.1 Observe and enforce construction safety measures of the National Building Code of Canada, the Worker's Compensation Act, The Workplace Safety and Health Act, The Department of Labour, Municipal Statutes, Bylaws and any other authorities applicable to this project. The Contractor is responsible for compliance with these standards for all workers engaged in the work of this Contract.

.2 Adhere to all railway railway company requirements, schedules and safety procedures.

.3 In event of conflict between any provisions of above authorities the most stringent provision will apply.

.4 Fires or burnings are not permitted on the project site. This will be permitted at the landfill with permission of Canada.

.5 Provide at least seventy-two (72) hours written notice to all utility companies and Canada in the immediate vicinity of his operations prior to the commencement of construction and shall, if requested, cooperate with such parties in the protection, removal or relocation of their installations and property.

.6 Develop, maintain and supervise for the duration of the work a comprehensive safety program that will effectively incorporate and implement all required safety precautions. The program shall, as a minimum, respond fully to the requirements of all applicable laws, ordinances, rules, regulations and orders and general construction practices for the safety of persons or property, including without limitation any general safety rules and regulations of the Canada and any Workers' Compensation or Occupational Health and Safety legislation or regulations that may be applicable (eg. WHMIS).

.7 Provide a copy of the safety program to the Department Representative for delivery to the Canada prior to the commencement of construction.

.8 Supply and maintain, at his own expense, at his site office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against accident or injury as prescribed by the governing authorities.

.9 Arrange regular safety meetings at his expense. Such meetings shall occur no less frequently than once per week. The Contractor shall record the minutes of such meetings and maintain a complete file for review by the appropriate authorities.

.10 Designate a safety officer who shall be qualified and authorized to supervise and enforce compliance with the safety program.

.11 Except as otherwise agreed to in the Contract, supply and maintain all articles necessary for giving first-aid to any person who may be injured on the job site and shall establish an emergency procedure for the immediate removal of any injured person to a hospital or a doctor's care in accordance with applicable legislative and regulatory requirements.

.12 Report in writing to Canada and the Department Representative all accidents of any sort arising out of or in connection with the performance of the work whether on or adjacent to the job site, giving full details and statements of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the Contractor to Canada and the Department Representative by telephone or messenger in addition to any reporting required under provincial laws and regulations.

.13 If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to Canada and the Department Representative, giving full details of the claim.

.14 Night work will only be performed by the Contractor if permission is given beforehand by the appropriate authorities. When work is carried out at night, the Contractor shall supply a sufficient number of electric or other approved lights to enable the work to be done in a safe and satisfactory manner.

.15 When the use of explosives is necessary for the performance of the work, observe the utmost care not to endanger life or property. The method of storing and handling explosives and highly inflammable materials shall conform to all applicable statutes, bylaws and regulations and the Contractor shall be responsible for obtaining all required permits thereunder.

.16 Perform all work in a fire-safe manner and comply with all applicable governmental legislation and, without limiting the generality of the foregoing, shall supply and maintain at the job site adequate and proper firefighting equipment.

.17 **All Contractors shall be COR certified. Proof of certification shall be supplied.**

## 1.2 Work in Hazardous Areas

.1 Before commencing the day's work and while working in areas which may contain an explosive, toxic or oxygen deficient atmosphere, the Contractor shall test for explosive or toxic gases or oxygen deficiency. If a hazardous condition is found, the Contractor shall make the work area safe before commencing or continuing work.

.2 Use non-sparking tools in areas where an explosive atmosphere may exist.

.3 Provide, mount and maintain signs warning all of the hazards and of the proper procedures required for working in the hazardous areas.

## 1.3 Use of Explosives

.1 When the use of explosives is necessary for the prosecution of the work, the Contractor shall observe the utmost care so as to not endanger life and property. Whenever directed, the number and size of charges shall be reduced.

.2 All explosives shall be stored in a secure and safe manner. All storage places shall be clearly marked "Dangerous Explosives".

.3 All storage places shall be in the care of a competent watchman at all times.

.4 The method of storing and handling explosives and highly inflammable materials shall conform to all statutes, bylaws and regulations pertaining thereto.

.5 No work shall be undertaken using explosives without a Safe Work Permit issued by Canada.

**1.4 Overloading**

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

**1.5 Falsework**

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

**1.6 Scaffolding**

.1 Design and construct scaffolding in accordance with CSA S269.2-M87.

**1.7 Guard Rails and Barricades**

.1 Construct and maintain any guard rails and barricades required in connection with your work. Comply immediately with the Department Representative's instructions regarding guardrails.

**1.8 General Safety Requirements**

.1 Provide signal worker where signs or barricades do not provide adequate control and where excavation, cranes or hoisting equipment is in usage, such worker must be qualified to perform the work.

.2 All openings must be guarded with proper barricades or appropriate covers with warning identification.

.3 Guy wires erected by the Contractor must be identified with attached warning signs.

.4 All temporary heaters, lights and power cables, etc. must comply with the requirements of the Canadian Electrical Code and applicable regulations.

.5 Use proper entrances and routes in proceeding directly to the work under this contract and avoid passing through other operating locations on the project.

.6 Wear appropriate protective clothing suitable for the task to cover and protect the body.

.7 Safety glasses with face shields or other suitable eye protection must be worn when engaged in work where they will be subjected to flying objects, injurious light or heat rays, or any materials liable to injure or irritable to the eyes.

.8 CSA approved Industrial Headware/Z94.1 M1977.

.9 CSA approved Protective Footwear/Z195 M1984.

.10 Safety harness must be used where work platforms or staging complete with guardrails is impractical.

.11 Scaffolding, swing stages or other temporary work platforms must be constructed and maintained and used in compliance with Safety Regulations.

.12 Approved containers used to store drinking water must be clearly marked and must not be used for any other purpose.

.13 All excavations and trenches must be prepared and maintained in accordance with safety regulations.

.14 Instruct all workers of the emergency procedures established for the work site and their required response.

.15 Only authorized workers are permitted to operate, adjust and repair equipment. No equipment should be left running unattended.

.16 Alcohol and unauthorized drugs are prohibited on the property of the work site. Personnel using a medically prescribed drug may impair performance or judgement and must inform their supervisor in order that tasks may be assigned to ensure worker safety is considered.

.17 A standby worker must be located immediately outside of a confined space area to render assistance in the event of an unsafe or emergency condition. And all workers inside a confined space must wear a safety lifeline where a harmful atmosphere exists or may develop. An appropriate communication system must also be maintained between the standby worker and the inside worker(s).

.18 Provide for the use of the Department Representative safety equipment such as ropes, safety belts, combustible/hazardous gas and oxygen depletion meter. Provide casual labour to Department Representative's staff when entry is required to manholes or other areas which may be hazardous. The Department Representative is not allowed to enter such areas alone.

.19 All tools and equipment must comply to standards and regulations having jurisdiction at the work site. The Contractor assumes all risks for the use of same. This applies for the duration of the project.

.20 Work in the vicinity of Manitoba Hydro wires and poles to be completed to their requirements.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**PROTECTION OF ENVIRONMENT**

## 1. GENERAL

### 1.1 Fires

.1 All flammable waste will be removed on a regular basis and disposed of at an appropriate disposal site.

.2 Appropriate fire extinguisher(s) will be available on the Project Site. Such equipment will comply with and be maintained to, the manufacturers' standards.

.3 All on-site fire prevention/response equipment will be checked on a routine basis, in accordance with local fire safety regulations, to ensure the equipment is in proper working order at all times.

.4 Greasy or oily rags or materials subject to spontaneous combustion will be deposited and stored in appropriate receptacles. This material will be removed from the Project Site on a regular basis and will be disposed of at an appropriate waste disposal facility.

### 1.2 Disposal of Wastes

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

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

.3 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.5 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

### 1.3 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

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

### 1.4 Site Clearing & Plant Protection

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Restrict tree removal to areas indicated or designated by Department Representative.

## 1.5 Pollution Control

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

.2 Keep vehicle idling on site to a minimum

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

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

.5 All petroleum-powered equipment such as pumps, generators and associated fuel shall be stored entirely within a secondary containment structure area located at least 100 m from the water's edge. Containment shall have 110% capacity relative to the volume of fuel being stored and be large enough to completely contain all harmful materials should a spill, leak or overflow occur. Trucks carrying large fuel containers (tidy tanks) will be parked within the containment area.

.6 Any cleaning and/or servicing of vehicles, equipment and machinery at the work site shall occur at least 100 m from the water's edge.

.7 The Contractor shall prepare an Emergency Spill Response Plan appropriate to all on-site hazardous materials prior to the commencement of work, and key contacts and telephone numbers will be readily accessible to crews at all times.

.8 Any used oils or other hazardous liquids to be collected and disposed appropriately.

.9 Spill containment kits will be on site during construction and will be large enough to handle twice the maximum spill possible and capable of handling petroleum products in flowing water. Any fuel spill greater than 100 L will be reported immediately to a Manitoba Conservation Environment Officer.

## 1.6 Noise Elimination

.1 Reduce noise to as great an extent as possible at all times. Air compressing plants shall be equipped with silencers and the exhausts of all gasoline motors or other power equipment shall be provided with mufflers.

## 1.7 Relics and Antiquities

.1 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site or in buildings to be demolished, shall remain property of Canada. Protect such articles and request directives from Department Representative.

.2 Give immediate notice to Department Representative if evidence of archaeological finds are encountered during construction and await his written instructions before proceeding with work in this area.

## 1.8 Health & Safety

.1 Provide temporary fencing around work areas to prevent public access.

.2 Put up signage around the construction site.

**1.9 Dust Nuisance**

.1 The Contractor shall take such steps as may be required to prevent dust nuisance resulting from his operations whether within the right-of-way or elsewhere or by public traffic where it is the Contractor's responsibility to maintain a roadway throughout the work.

**2. PRODUCTS (NOT USED)**

**3. EXECUTION (NOT USED)**

**END OF SECTION**

**QUALITY REQUIREMENTS**

## 1. GENERAL

### 1.1 Inspection and Testing of Work

.1 Laboratories/Agencies

.1 Independent Inspection/Testing Agencies will be engaged by Canada for the purpose of inspecting and/or testing portions of Work for the purposes of determining whether the work completed is satisfactory for progress payment.

.2 Costs of the above services will be paid by Canada separately.

.3 All equipment required for carrying out the above inspection and testing will be provided by the respective Agencies.

.2 Contractor Responsibility

.1 It is the Contractor's responsibility to carry out all testing as identified in the Specifications and whatever testing he feels is required to ensure that the work is in conformance with the Contract Documents.

.2 The Contractor cannot rely on the testing that will be carried out by the independent testing agency for quality control by the Department Representative; the intention of this Testing is for determination by the Department Representative of satisfactory completed work for progress payment.

.3 All costs, beyond the testing by independent testing retained by Canada, deemed required the Contractor to ensure quality control shall be borne by the Contractor.

.3 Access to Work and Plant

.1 Allow the inspection/testing agencies access to all portions of Work on site and manufacturing and fabrication plants, as may be necessary to carry out their work. Cooperate to provide reasonable facilities for such access.

.4 Procedures for Tests

.1 Notify the Department Representative well in advance of the requirements for tests, in order that necessary arrangements can be made by the Department Representative with the respective agencies.

.2 Submit necessary samples and/or materials required for testing, as specifically requested in the Specifications. Submit with reasonable promptness and in an orderly sequence, so as to cause no delay in Work.

.3 Provide workers and facilities to obtain and handle samples and/or materials on-site. Provide sufficient space to facilitate the storage and curing of test samples.

.4 If defects are revealed during inspection and/or testing, the Department Representative may request additional inspection and/or testing to ascertain full degree of defects.

.5 The Contractor shall correct defects and irregularities and pay all costs for all additional testing.

.5 Contractor's Responsibility

.1 The Contractor shall carry whatever testing is felt required to ensure quality control.

.6 Rejected Work

.1 Defective work whether the result of poor workmanship, use of defective products, or damage through carelessness or other act of omission of the Contractor, and whether incorporated in the Work or not, which has been rejected by the Department Representative as failing to conform to the Contract Documents shall be removed promptly from the Work and replaced or re-executed by the Contractor in accordance with the Contract Documents at the Contractor's expense.

.2 Other work destroyed or damaged by such removals, replacements or re-execution shall be made good promptly at the Contractor's expense.

## 1.2 Tests and Mix Designs

.1 Furnish to the Department Representative test results and mix designs as specifically requested in the Specifications. The cost of test results and mix design shall be borne by the Contractor.

.2 Furnish test results as indicated below:

.1 Pressure leak testing as specified in Section 33 10 00 and 33 30 00.

.2 Disinfection of watermains as specified in section 33 10 00.

.3

| Material | Test | Frequency |
|---|---|---|
| Bedding Sand | Sieve Analysis | 1 per source |

## 1.3 Reference Standards

.1 Refer to Division 26 specifications for electrical testing requirements.

.2 Within the text of the Specifications, reference may be made to the following standards:

| | |
|---|---|
| ACI | American Concrete Institute |
| AISC | American Institute of Steel Construction |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing and Materials |
| AWWA | American Water Works Association |
| CAN | National Standard of Canada |
| CEC | Canadian Electric Code (published by CSA) |
| CGA | Canadian Gas Association |
| CGSB | Canadian Government Specification Board |
| CISC | Canadian Institute of Steel Construction |
| CLA | Canadian Lumberman's Association |
| CPCA | Canadian Printing Contractors Association |

| | |
|---|---|
| CPCI | Canadian Prestressed Concrete Institute |
| CRCA | Canadian Roofing Construction Association |
| CSA | Canadian Standards Association |
| DIN | Deutsches Institut Normung |
| EEMAC | Electrical and Electronic Manufacturer's Association of Canada |
| EIB | Electrical Inspection Branch |
| FMEC | Factory Manual Engineering Corporation |
| IEEE | Institute of Electrical and Electronic Engineers |
| IPCEA | Insulated Power Cable Engineers Association |
| NAAMM | National Association of Architectural Metal Manufacturers |
| NACE | National Association of Corrosion Engineers |
| NBC | National Building Code |
| NEMA | National Electric Manufacturers Association |
| NFPA | National Fire Protection Association |
| NWTI | National Wood Tank Institute of the U.S.A. |
| TTMAC | Terrazzo, Tile and Marble Association of Canada |
| ULC | Underwriters Laboratories of Canada |

Conform to the latest version of such standards available at the time of tendering, in whole or in part, as specified.

.3 If there are questions as to whether any product of system is in conformance with applicable standards, the Department Representative reserves the right to have such products or systems tested to prove or disprove conformance with Contract Documents, or by the Contractor in the event of non-conformance.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**TEMPORARY FACILITIES**

## 1. GENERAL

### 1.1 Access

.1 Provide and maintain adequate access to project site and existing facilities.

.2 Build and maintain temporary roads and provide snow removal during period of work.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.'

### 1.2 Temporary Utilities

.1 The Contractor will be required to make his own arrangements in connection with the temporary use of lighting, power, gas, sewer, water or other utilities, and pay all costs in connection therewith. All necessary permits, fees, etc., as well as the cost of temporary connections to existing facilities shall be arranged for and paid for by the Contractor.

.2 The Contract is advised that the current watermain to the VRC building is out of service. There is no requirement to provide temporary water supply during the replacement of watermain.

### 1.3 Contractor's Site Office

.1 Provide office heated to 22$^{o}$C, lighted 750 Lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table and telephone.

.2 Allow Department Representative access to Contractor's site office during working hours.

### 1.4 Storage Sheds

.1 Provide adequate weathertight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.

### 1.5 Sanitary Facilities

.1 Canada will allow the Contractor to use the facilities within the VRC building to ensure they have appropriate and safe facilities.

.2 Contractor to maintain the facilities in clean and sanitary condition.

### 1.6 Parking

.1 Parking will be permitted on site. Maintain and administer this space as directed.

### 1.7 Enclosure of Structures

.1 Provide temporary weather tight enclosures and protection for exterior openings until permanently enclosed.

.2 Erect enclosures to allow access for installation of materials and working inside enclosure.

## 1.8 Power

.1 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.

.2 Install temporary facilities for power such as pole lines and underground cables to approval of local power supply authority.

.3 Electrical power and lighting systems installed under this Contract may be used for construction requirements with prior approval of Department Representative provided that guarantees are not affected. Make good damage. Replace lamps which have been used over period of 3 months.

## 1.9 Heating and Ventilating

.1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment. Use of direct-fired heaters discharging waste products into work areas will not be permitted.

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

.1 Facilitate progress of work.

.2 Protect work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment.

.3 Ventilating:

.1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

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

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

**1.10 Drainage**

.1 Refer to Section 01 35 43 for site drainage and pumping requirements.

**1.11 Site Signs and Notices**

.1 Only Project Identification and Department Representative/Contractor signboards and notices for safety or instruction are permitted on site.

.2 Format, location and quantity of site signs and notices to be approved by Department Representative.

.3 Signs and notices for safety or instruction to be in French and English language, or commonly understood graphic symbols.

.4 Maintain signboards, signs and notices for duration of project. Remove and dispose of signs off site when directed by Department Representative.

.5 Provide construction sign in location indicated or where directed by Department Representative.

**1.12 Scaffolding**

.1 Construct and maintain scaffolding in rigid, secure and safe manner.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required. Refer to Section 01 35 29 for safety requirements for scaffolding.

**1.13 Removal of Temporary Facilities**

.1 Remove temporary facilities from site when directed by Department Representative.

**2. PRODUCTS (NOT USED)**

**3. EXECUTION (NOT USED)**

**END OF SECTION**

**EROSION AND SEDIMENTATION CONTROL**

## 1. GENERAL

### 1.1 General

.1 All activities associated with construction within the community will be conducted in accordance with accepted practices outlined in the following documents:

.1 Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (DFO and Manitoba DNR, 1996);

.2 Manual of Erosion and Sedimentation Control During Highway Construction (Manitoba Transportation and Government Services [MTGS] n.d.a);

.3 Manual for the Design and Implementation of Erosion and Sediment Control: Quick Reference Manual (MTGS n.d.b);

.4 Sediment and Erosion Control (Manitoba Heavy Construction Association 2001);

### 1.2 Scheduling of Work

.1 Develop schedule of work such that measures are in place to control erosion and sedimentation prior to earthworks.

## 2. PRODUCTS (NOT APPLICABLE)

## 3. EXECUTION

### 3.1 General Erosion & Sedimentation Control

.1 Introduction of sediments to surface waters shall be avoided due to the potential to impact upon fish habitat.

.2 Where used, silt fences must be trenched and anchored below grade, and geotextile fabrics and fibre mats must be anchored to the ground surface. Once installed, any silt fences or geotextile fabric will be gap-free and sufficiently strong to withstand wind pressure and high water flows. Silt fences and other synthetic materials will not be left below the high water mark of any watercourse over winter, due to the risk of damage, washout or burial during the following spring freshet.

### 3.2 Monitoring

.1 Erosion and sediment control measures will be inspected regularly during construction and afterwards to ensure that they are functioning properly and are maintained and/or upgraded as required until vegetation has been re-established on the disturbed area.

**END OF SECTION**

## 1. GENERAL

### 1.1 Quality of Product

.1 All materials, equipment and articles incorporated in the Work are to be new, not damaged or defective and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided. Where applicable, products shall bear evidence of certification by CSA, Canadian Underwriters Laboratory, or applicable regulatory body.

.2 Defective materials, equipment and articles wherever found may be rejected, regardless of previous inspection. Inspection by the Department Representative or an inspector does not relieve the Contractor of his responsibility but is merely a precaution against oversight or error. Remove and replace defective materials at no cost to Canada and be responsible for all delays and expenses caused by rejection.

.3 Unless otherwise indicated in the specifications, maintain uniformity of manufacturer for any particular or like item throughout the Contract.

### 1.2 Availability of Products

.1 Immediately upon signing the Contract, review product requirements and anticipate foreseeable delivery delays in any items. If delays in deliveries of materials, equipment or articles are foreseeable, notify the Department Representative in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performing the work.

.2 If such notice is not given to the Department Representative, the Department Representative reserves the right to substitute more readily available products later in order to prevent delays at no additional cost to the Canada.

.3 No substitution of any item will be permitted unless the specified or accepted item or items cannot be delivered to the job site in time to comply with the schedule.

.4 To receive acceptance, proposed substitutes must equal or exceed the quality, finish and performance of those specified and/or shown and must not exceed the space requirements allotted on the Drawings.

.5 Provide documentary information so that the Department Representative can ascertain whether the substitution is equal to the item specified. Indicate delivery dates of both specified items and proposed substitutions.

.6 Indicate any required revisions to other structures and products to accommodate such substitutions.

### 1.3 Storage, Handling and Protection of Products

.1 Handle and store products in a manner to prevent damage, contamination, deterioration, and soiling, and in accordance with manufacturer's recommendations when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Products subject to damage from weather are to be stored in weatherproof enclosures, heated if required.

.4 Store cementitious materials clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet material and lumber on flat, solid supports and keep clear of ground.

.7 Remove and replace damaged products at own expense and to the satisfaction of the Department Representative.

**1.4 Manufacturer's Directions**

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

.2 Notify the Department Representative, in writing, of any conflicts between the specifications and manufacturers' instructions.

.3 Improper installation or erection of products due to failure in complying with these requirements shall be removed and re-installed. These costs shall be borne by the Contractor.

**1.5 Transportation Costs of Products**

.1 Pay all costs of transportation of products required in the performance of the Work. Be responsible for ensuring that sub-contractors include the costs of transporting products which are part of their work.

**2. WORKMANSHIP**

**2.1 General Requirements**

.1 Workmanship is to be of the best quality, executed by workers fully experienced, licenses and skilled in their respective trades. Immediately notify Department Representative if work is required in such a manner as to make it impracticable to produce required results.

.2 Provide competent supervisors to ensure the quality of the work.

.3 The construction superintendent must remain on this project for its duration unless his employment is terminated.

.4 Arrange and install products to fit properly into the designated spaces.

**2.2 Concealment**

.1 In finished areas, conceal all pipes, ducts, and wiring except where indicated otherwise on Drawings or in specifications.

.2 Before installation, inform the Department Representative if there is a contradictory situation. Install as directed.

.3 Provide furred spaced to enclose those items from view as required.

**2.3 Location of Fixtures**

.1 Consider the location of fixtures, outlets and other mechanical and electrical items indicated on Drawings are approximate. The actual location of these items is to be as required or directed to suit conditions at the time of installation and as is reasonable.

.2 Before installation inform the Department Representative of an impending installation. Install as directed.

**2.4 Cutting and Remedial Work**

.1 Perform all cutting and remedial work that may be required to make the several parts of Work join together properly. Co-ordinate and schedule the Work to ensure that cutting and remedial work are kept to a minimum.

.2 Employ specialists familiar with the materials affected to performing cutting and remedial work. Perform in a manner to neither damage nor endanger any portion of Work.

.3 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.

.4 Obtain Department Representative's approval before cutting, boring or sleeving load-bearing members.

.5 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly. Perform repair work for new work.

.6 Fit work airtight to pipes, sleeves, ducts and conduits unless otherwise noted.

.7 Provide opening and holes required in cast-in-place and precast members for mechanical and electrical work.

.8 Drill for expansion bolts, hanger rods, brackets and supports.

.9 Cast holes larger than 150 mm in diameter unless noted otherwise. Field cut holes 150 mm in diameter and smaller using diamond core drilling equipment.

**2.5 Fastenings**

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

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive, non-staining fasteners and anchors for securing exterior work unless otherwise specified.

.4 Space anchors within their load limit or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and lay out neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made, are not acceptable.

**2.6 Protection of Work in Progress**

.1 Adequately protect all work completed or in progress. Repair or replace all damaged work as required by the Department Representative.

.2 Prevent overloading of any part of the building. Do not cut, drill, or otherwise sleeve any load bearing structural member, unless indicated otherwise on Drawings or in specifications, without written agreement of the Department Representative.

**2.7 Existing Mains and Services**

.1 Where work involves breaking into or connecting to existing mains and services, carry out work in full co-operation with plant operating personnel.

.2 Before commencing Work, establish location and extent of mains and service lines in area of Work and notify Department Representative of findings.

.3 Submit schedule to obtain approval from Department Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

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

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

**3. PRODUCTS (NOT USED)**

**4. EXECUTION (NOT USED)**

**END OF SECTION**

**PROJECT CLOSEOUT**

## 1. GENERAL

### 1.1 Clean-Up and Final Cleaning of Work

.1 Maintain Work in a tidy condition and free from accumulation of waste products and debris at all times.

.2 Remove all waste materials and debris from the site or dispose of as otherwise directed by the Department Representative. Do not burn waste materials on site.

.3 Perform the following immediately prior to application for Final Certificate of Completion:

.1 Remove nonessential labels.

.2 Remove stains, spots, marks, and dirt from electrical and mechanical fixtures, ceilings, walls and floors.

.3 Vacuum clean all building interiors.

.4 Make a thorough inspection of all finishes, fixtures, and equipment and ensure proper workmanship and operation.

.5 Sweep and wash clean exterior walks, steps, platforms, and paved areas.

.6 Remove all dirt and other disfigurations from exterior surfaces.

.4 When Work is completed, remove all waste products, debris, surplus products, tools, construction machinery, and equipment not required for the performance of the remaining Work. Leave the work area clean, suitable for occupancy by Canada.

.5 When the Work is totally completed to the satisfaction of the Department Representative, remove all surplus products, tools, construction machinery, and equipment. Also, remove any waste products and debris.

### 1.2 Performance Assurance

.1 Before application for an Interim Certificate of Completion, forward to the Department Representative a list summarizing when the originals of all inspection and approval certificates, test reports, warranties, maintenance manuals, operating instructions, record drawings, and other documents specifically required by the Contract Documents were forwarded to the Department Representative. Supply any documents required but not submitted.

### 1.3 Administrative Requirements

.1 Acceptance of Work Procedures:

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

.1 Notify Department Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Department Representative’s inspection.

.2 Department Representative's Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, and fully operational.

.4 Operation of systems: demonstrated to Departmental Representative.

.5 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 When Work incomplete according to Department Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Canada's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When Department Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**OPERATION AND MAINTENANCE MANUALS**

## 1. GENERAL

### 1.1 General

.1 The Contractor shall submit four (4) copies of Operating and Maintenance manuals for all pieces of equipment or material that are contained with the Specifications.

.1 All instructions shall be in English and in S.I. units to guide the Canada's Personnel in the proper operation and maintenance of its installation and the equipment.

.2 The maximum width of each binder shall not exceed 100 mm; where there is more data than will fit in a binder of 100 mm maximum width, the number of binders shall be as required.

.2 In addition to the bound material, supply one CD of the entire manuals.

### 1.2 Binder Type

.1 The Binders shall be hard cover exterior with post type chrome piano hinge type binders to take 215 mm x 280 mm size paper.

.2 Binder covers shall include the following:

- Date:
- Name of Project: VRC Watermain Replacement Project
- Owner: Parks Canada Agency
- Contractor:
- Department Representative:
- Designation: "Operating and Maintenance Manual"
- Division Number(s):

.3 The above shall be embossed or silk screened on the binder exterior; on the front and sides of the binders.

.4 The binders (with above information) shall be submitted to Department Representative for review prior to final printing.

.5 Contents

.1 In addition to information called for in the Specification, include the following:

.1 Organize contents into the applicable DIVISIONS as set out in Specification breakdown.

.2 Drawings larger than 210 mm x 300 mm (A4) shall be contained in plastic pouch.

.3 Provide a separate panel for each drawing.

.4 The following information in addition to information contained with the specifications shall be required:

.1 Title sheets, labelled "Operation and Maintenance Instructions", and containing project name and date.

.2 List of contents, tagged per equipment list.

.3 Index tabs per specification section.

.4 Complete sets of final shop drawings incorporating any field changes of all pieces of equipment installed in the project with information as outlined for shop drawings.

.5 Complete parts list for each piece of equipment.

.6 Recommended spare parts list for each piece of equipment.

.7 Complete and detailed literature detailing operating and maintenance instructions for each piece of equipment.

.8 Complete and detailed lubricating and servicing schedule and recommended lubricants to be utilized.

.9 Complete list including address, phone number and representatives' names of the equipment manufacturers and local service representatives.

.10 Equipment and valve schedules.

.11 Full description of entire relevant system and its operation.

.12 A copy of all wiring diagrams, complete with wire coding.

.13 A copy of all calibration, verification, and test data.

.14 Motor data survey sheets and control wiring diagrams.

.15 The type and accuracy of all test instruments used.

.16 Details of design elements, construction features, component function and maintenance requirements to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.17 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature not acceptable.

.18 Wiring and schematic diagrams of all equipment.

.19 Guarantees, warranties, and bonds showing:

.1 Name and address of projects

.2 Guarantee commencement date, date of Final Certificate of Completion

.3 Duration of guarantee

.4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee

.5 Signature and seal of Contractor

.6 Additional material used in project listed under various sections showing name of manufacturer and source of supply

**2. PRODUCTS (NOT USED)**

**3. EXECUTION (NOT USED)**

**END OF SECTION**

**PROTECTING EXISTING SERVICES AND UTILITIES**

## 1. GENERAL

### 1.1 Existing Services and Utilities

.1 No responsibility will be assumed by Canada or the Department Representative for correctness or completeness of the Drawings with respect to the existing utilities, pipes or other objects either underground or on the surface, and neither Canada nor the Department Representative shall be liable for the incorrectness and inadequacy thereof. It shall be the responsibility of the Contractor to determine the location of all such utilities, pipes and other objects and to make good any damage done to them.

.2 The Contractor shall perform the relocation of existing slabs, buildings, utilities, poles, signs, fences, etc. which interfere with the proposed construction. This shall be performed only through prior consultation and approval by Canada. These removals or relocations are considered incidental to other pay items in this contract. The Contractor shall also make the necessary arrangements for and pay the cost of all relocation required for his convenience.

### 1.1 Hydro and M.T.S. Lines

.1 When Underground Works occur within two metres of a steel light, Hydro or M.T.S. pole, the Contractor shall make arrangements with the authority concerned regarding temporary support and/or relocation of the poles at the Contractor's expense. Under the above condition, the Contractor shall use (a) mechanically tamped clay and/or granular material for trench backfill, (b) tunnel a minimum of 1.3 metres on each side of the pole and install the pipe in tunnel construction, or (c) as otherwise specified by the utility concerned.

.2 The Contractor shall make himself fully aware of the conditions in the work area prior to submitting his Tender and no payment will be made for any work required as per this item.

## 2. PRODUCTS (NOT USED)

## 3. EXECUTION (NOT USED)

**END OF SECTION**

**CAST-IN-PLACE CONCRETE**

## 1. GENERAL

### 1.1 Work Included

.1 Supply of all reinforced cast-in-place concrete shown on the Drawings.

.2 Setting anchors, inserts, frames, sleeves, and other items supplied by other sections.

.3 Repairing concrete imperfections.

.4 Finishing concrete slab surfaces.

.5 Placing and curing of concrete.

### 1.2 References

.1 National Building Code of Canada 2010 and the Manitoba Amendments.

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

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

.4 ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete.

.5 ASTM C494, Standard Specification for Chemical Admixtures for Concrete.

### 1.3 Shop Drawings and Submittals

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

### 1.4 Quality Control

.1 The Contractor shall be fully responsible for quality control of all aspects of production, pre-placement, placement, and post-placement of concrete and related testing.

.2 Cast-in-place concrete shall conform to the CSA A23.1. Concrete shall be delivered under the Performance alternative as outlined in CSA A23.1, Table 5.

### 1.5 Quality Assurance

.1 Checklists supplied by the Contractor will be used by the Department Representative for reviewing the Work.

.2 Notify the Department Representative at least seventy-two (72) hours before complete formwork, embedded items, and concrete reinforcement are ready for review. Embedded items and reinforcing in walls shall be reviewed prior to closing forms.

.3 Allow ample time for review and corrective work, if required, before scheduling concrete placement.

## 2. PRODUCTS

### 2.1 General

.1 All materials in concrete mixes shall be compatible.

### 2.2 Concrete Materials

.1 Portland Cement: Type GU and Type HS or HSb conforming to CSA A3000.

.2 Supplementary cementing materials: conforming to CAN/CSA-A3000.

.3 Fine aggregate: conforming to Normal-Density Fine Aggregate, CSA 23.1, Table 10 and Table 12. Provide evidence at least four (4) weeks before use in concrete mix showing conformance to Normal-Density Fine Aggregate, CSA A23.1.

.4 Coarse aggregate: conforming to Normal-Density Coarse Aggregate, CSA 23.1, Table 11 and Table 12. Provide evidence at least four (4) weeks before use in concrete mix showing conformance to Normal-Density Coarse Aggregate, CSA A23.1.

.5 Ensure that no aggregates are used that may undergo volume change due to alkali reactivity, moisture retention, or other causes. Confirm suitability of aggregate with a petrographic analysis.

.1 The aggregate classification of the degree of alkali-silica reactivity shall be ‘Non-reactive’; one-year expansion shall be less than 0.040% as per CSA A23.2-14A and 27A.

.2 The aggregate classification for alkali-carbonate reactivity shall be aggregates considered ‘Non-expansive’ due to ACR as per CSA A23.2-14A and 26A.

.6 Water: potable, clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious matter, meeting requirements of CSA A23.1, Table 9.

.7 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the project.

### 2.3 Concrete Mixes

.1 Provide concrete mixed in accordance with requirements of CSA A23.1 and this Specification Section. Pay all costs for the mix designs.

.2 Concrete design compressive strength to be 35 MPa at 28 days and S-1 class of exposure.

.3 Concrete mixes are to be designed to mitigate dry and plastic temperature and shrinkage cracks.

.4 Use accelerating admixtures in cold weather only when accepted by the Department Representative. If accepted, the use of admixtures will not relax cold weather placement requirements. Do not use calcium chloride.

.5 Use set-retarding admixtures during hot weather only when accepted by the Department Representative.

.6 All admixtures are subject to acceptance by the Department Representative. List all proposed admixtures in mix design statement submission. Do not change or add admixtures to the submitted and reviewed design mixes without the Department Representative's review and acceptance.

.7 Self-consolidating concrete mixes will not be permitted for use on this project.

**2.4 Admixtures**

.1 Air entrainment: conforming to ASTM Standard C260.

.2 Chemical admixtures, water-reducing agent, superplasticizer: conforming to ASTM Standard C494.

.3 Admixtures containing chloride will not be permitted.

**2.5 Accessories**

.1 Moisture retention film: Master Builders Confilm, Sika Film, or TK Products Tri-Film.

.2 Repair mortar: Meadow-Crete H by W.R. Meadows.

**3. EXECUTION**

**3.1 Placing Concrete**

.1 Place concrete in accordance with requirements of CSA A23.1 and as indicated on the Drawings. Layout of the Work and accuracy of same is the Contractor's sole responsibility.

.2 Place concrete to mitigate dry and plastic temperature and shrinkage cracks.

.3 Notify the Department Representative a minimum of seventy-two (72) hours prior to placing concrete. Under no circumstances shall concrete be placed without notifying Department Representative.

.4 Arrange for testing of cast-in-place concrete.

.5 The concrete shall be placed rapidly and evenly as near to its final position as possible to reduce the risk of segregation, flow lines, and cold joints.

.6 Ensure all anchor bolts, seats, plates, and other items to be cast into concrete are securely placed and will not interfere with concrete placement and will not be displaced during casting.

.7 All equipment for transporting the concrete shall be cleaned of hardened concrete and foreign materials before placing concrete.

.8 Immediately before concrete is placed, Contractor shall carefully inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel and embedded parts are in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and material removed.

.9 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling or flowing. Vibrators shall not be used to move concrete. Under no circumstances shall concrete that has partially hardened, be deposited in the forms.

.10 Concrete shall be thoroughly compacted by mechanical vibrators during placing operations. Concrete shall be thoroughly worked around the reinforcement, embedded fixtures, and into the corners of the forms.

.11 Vibrate concrete using the appropriate size equipment as placing proceeds, in accordance with CSA A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.12 Do not place concrete if carbon dioxide producing equipment has been in operation in the building or in the enclosure during the twelve (12) hours preceding the placing. This equipment shall not be used during placing or for twenty-four (24) hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases, or drying from heaters.

.13 Honeycomb or embedded debris is not acceptable.

.14 Remove and replace defective concrete.

.15 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

## 3.2 Hot and Cold Weather Concreting

.1 Deliver, place, and cure concrete in hot or cold weather in accordance with the requirements in CSA A23.1.

## 3.3 Concrete Protection for Reinforcement

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with Section 03 21 00 Reinforcement Bars.

## 3.4 Construction Tolerance

.1 The Work shall be carefully and accurately set out; true to the positioning, levels, slopes, and dimensions shown on the Drawings and conforming to tolerance requirements of CSA A23.1 and Section 03 10 00 - Concrete Formwork and Section 03 21 00 Reinforcement Bars

.2 If these tolerances are exceeded, the Contractor may, at the discretion of the Department Representative, be required to remove and replace or to modify the placed concrete before acceptance. The costs incurred by the Department Representative for such investigation, testing, or review of reconstruction and the cost of reconstruction shall be borne by the Contractor.

## 3.5 Finishing Slab Surfaces

.1 Screeding, bull floating or darbying, floating, and trowelling of slab surfaces shall conform to CSA A23.1, Clause 7.5 – Finishing and Treatment of Slab or Floor Surfaces, and as specified below.

.1 Maintain surface flatness of maximum 6 mm in 3 m. Bull float and hand trowel concrete utilizing magnesium trowels.

## 3.6 Finishing Formed Concrete

.1 Allow the Department Representative to review concrete surfaces immediately upon removal of the forms.

.2 Modify or replace concrete not conforming to qualities, lines, details, and elevations specified herein or indicated on the Drawings to the acceptance of the Department Representative.

.3 Finish for the exterior side surfaces of the SL-1: Rough-Form Finish conforming to CSA A23.1, Clause 7.7.2.5.

## 3.7 Curing and Protection

.1 Cure and protect freshly placed concrete in accordance with CSA A23.1.

.2 All concrete shall receive moist curing for a period of at least seven (7) calendar days. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

.1 Surface covered with canvas or other satisfactory material and kept thoroughly and continuously wet with soaker hoses.

.2 A liquid membrane forming a curing sealer, applied at the rate recommended by the Manufacturer. Curing sealer shall not be used on a surface where bond is required for another finish.

.3 Surfaces of concrete that are protected by formwork left in place for seven (7) calendar days do not require any additional curing (except as specified for hot weather). If the formwork is removed in less than seven (7) calendar days, the concrete shall receive moist curing as above.

.3 No concreting will be allowed until all materials required for the curing phase are on Site and ready for use.

.4 At the end of the curing and protection period, the temperature of the concrete shall be reduced gradually at a rate meeting both the requirements of CSA A23.1 Table 21 for allowable differential temperature in the concrete and ACI 306R Table 5.5 for the allowable rate of temperature change of the edges of the concrete until the outside air temperature has been reached.

.5 Concrete that is allowed to freeze or attain insufficient curing conditions shall be subject to all necessary investigations and testing as deemed necessary by the Department Representative

and all such concrete shall be subject to removal and reconstructed as directed by the Department Representative, at the Contractor's cost.

.6 Supply and arrange for water for curing concrete.

**3.8 Accessories**

.1 Install all concrete accessories in accordance with the Manufacturer's recommendations and ensure compatibility.

**3.9 Defective Concrete**

.1 Concrete not meeting the requirements of the Specifications and Drawings will be considered defective concrete.

.2 Concrete not conforming to the lines, details, and grades specified herein or as shown on the Drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Department Representative. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein and in Section 03 10 00 - Concrete Formwork and Section 03 21 00 - Concrete Reinforcement.

.3 Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Department Representative.

**3.10 Repair**

.1 Allow Department Representative to review concrete surfaces immediately upon removal of all formwork.

.2 Remove all exposed metal form ties, nails and wires, break off fins, and remove all loose concrete.

.3 Any imperfect joints, voids, stone pockets, or other defective areas and tie holes, as specified, shall at once be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 40 mm with the edges perpendicular or slightly dovetailed to the surface. The area to be repaired and a space at least 150 mm wide entirely surrounding it shall be wetted to prevent absorption of water from the repair mortar.

.4 Cure all repairs thoroughly in accordance with the Manufacturer's instructions.

**3.11 Repair Mortar**

.1 Apply repair mortar for concrete repairs as directed by the Department Representative.

.2 Prepare surfaces and apply repair mortar to Manufacturer's instructions. Use pea gravel to extend the mixture in accordance with the Manufacturer's instructions.

.3 Latex patching agent is to be used for patching formed concrete surfaces where required.

**END OF SECTION**

**COMMON WORK RESULTS FOR ELECTRICAL**

## 1. GENERAL

### 1.1 References

.1 Canadian Standards Association (CSA International):

.1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.3 No.7 Underground Systems.

.2 Underwriters' Laboratories of Canada (ULC).

.3 ETL Testing Laboratories (ETL).

.4 American National Standards Institute (ANSI).

.5 National Fire Protection Association (NFPA).

.6 Manitoba Housing Design Guide.

.1 Lighting Design Guideline No. EE-01.

### 1.2 Design Requirements

.1 Operating voltages: to CAN3-C235.

.2 Distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

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

### 1.3 Action and Informational Submittals

.1 Submittals: in accordance with Section 01 00 00 – General Requirements and Section 26 50 16 Submittals.

.2 Shop Drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

### 1.4 Quality Assurance

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid license or apprentices in accordance with Authorities Having Jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

**1.5 Delivery, Storage and Handling**

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling.

**2. PRODUCTS**

**2.1 Materials and Equipment**

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.

**2.2 Wiring Identification**

.1 Identify wiring with permanent indelible identifying markings engraved on lamacoid attached with UV resistant fasteners showing circuit numbers of all feeders and branch circuit cables and conductors.

.2 Colour coding: to CSA C22.1.

**3. EXECUTION**

**3.1 Installation**

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do underground systems in accordance with CSA C22.3 No.7 except where specified otherwise.

**3.2 Nameplates and Labels**

.1 Ensure Manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

**3.3 Conduit and Cable Installation**

.1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

## 3.4 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

## 3.5 Field Quality Control

.1 Conduct following tests:

.1 Circuits originating from branch distribution panels.

.2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

**END OF SECTION**

**WIRE AND BOX CONNECTORS (0-1000V)**

## 1. GENERAL

### 1.1 References

.1 CSA International (Latest Editions)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 National Electrical Manufacturers Association (NEMA)

.1 C119.4 Connectors for Use between Aluminum-to-Aluminum and Aluminum-to-Copper, and Copper-to-Copper.

### 1.2 Action and Informational Submittals

.1 Submit in accordance with Division 01 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [wire and box connectors] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Sustainable Design Submittals:

.1 Construction Waste Management:

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

### 1.3 Closeout Submittals

.1 Submit in accordance with Division 01 – Project Closeout.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

### 1.4 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with Division 01 – Product and Workmanship Requirements and 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 the floor indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wire and box connectors from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Division 01 - Construction/Demolition Waste Management and Disposal.

## 2. PRODUCTS

### 2.1 Materials

.1 Service and Power Feeder Cables

.1 Compression type terminations for copper incoming power service cables. Utility approved compression type connectors at transformer, for installation by utility.

.2 Compression type terminations for all feeder connections.

.2 Splicing only to be performed inside of suitable rated boxes.

.1 General locations: Fixture type splicing connectors (Marette twist on) to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.2 Wet Locations or Underground: Use CSA splice kits suitable for direct burial to ensure moisture seal.

.3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CSA-C22.2 No.18.3, 18.4 and 18.5.

.1 Provide appropriate terminals or power distribution blocks.

.4 Bushing stud connectors to consist of:

.1 Connector body and stud clamp for stranded round copper conductors.

.2 Clamp for stranded round copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

## 3. EXECUTION

### 3.1 Examination

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connector's installation in accordance with manufacturer's written instructions.

.1 Inform General Contractor of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

### 3.2 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 For Compression Type

.1 Install all compression terminations and connectors using purpose made mechanical tool.

.2 For aluminum compression terminations also apply conductive paste to conductor ends.

.2 For Fixture type splicing connectors (Marette twist on [wire nut])

.1 Twist wires together, insert into cap and tighten.

.2 Place a strip of electrical tape over the full circumference of the cap ensuring the gap between the cap and the wires is covered. Firmly press tape in place.

.3 Installation shall pass tug test, and meet secureness tests in accordance with CSA C22.2 No.65.

.4 Install bushing stud connectors per manufacturers requirements, and in accordance with NEMA.

### 3.3 Cleaning

.1 Progress Cleaning: clean in accordance with Division 01 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01 – Project Closeout.

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**WIRES AND CABLES (0-1000V)**

## 1. GENERAL

### 1.1 References, Codes, Standards

.1 Canadian Standards Association (CSA)

.1 CSA 22.1, Canadian Electrical Code (CEC), Part 1), Safety Standard for Electrical Installations,

.2 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables,

.3 CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables,

.4 CSA 22.2 No. 131, Type TECK 90 Cable,

### 1.2 Product Data

.1 Provide product data in accordance with Division 01 - Submittal Procedures.

.2 Coordinate with Division 26 – Electrical System Studies.

.1 Provide complete run lengths for all power cables from Equipment A to Equipment B.

.1 Provide cable type (i.e. RW90, Teck90, THWN, etc.),

.2 Provide Conductor type (ie. Alumimum or Copper)

.3 Provide Number of Conductors in cable, and size of conductors.

.4 Provide Number of Conductors per phase.

## 2. PRODUCTS

### 2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE. RWU90 XLPE for grounding pigtails.

### 2.2 Teck 90 Cable

.1 Cable: in accordance with Division 26 - Common Work Results for Electrical.

.2 Conductors:

.1 Grounding conductor: copper

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Cross-linked polyethylene XLPE.

.2 Rating: 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, [compliant to applicable Building Code classification for this project].

.7 Fastenings:

.1 One whole malleable iron, steel, aluminum, zinc straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

### 2.3 Control Cables

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: PVC.

.2 Type: low energy 300 V control cable: solid, or stranded annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: PVC, polyethylene.

## 3. EXECUTION

### 3.1 Field Quality Control

.1 Perform tests in accordance with Division 26 - Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

### 3.2 General Cable Installation

.1 Lay cable in cable trays in accordance with Division 26 - Cable Trays for Electrical Systems.

.2 Terminate cables in accordance with Division 26 - Wire and Box Connectors - (0-1000 V).

.3 Cable Colour Coding: to Division 26 - Common Work Results for Electrical.

.4 Conductor length for parallel feeders to be identical.

.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

## 3.3 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Division 26 - Conduits, Conduit Fastenings and Conduit Fittings, and as indicated on the Drawings.

## 3.4 Installation of Teck90 Cable (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 In conduit systems in accordance with Division 26 - Conduits, Conduit Fastenings and Conduit Fittings, and as indicated on the Drawings.

.3 In cable tray systems in accordance with Division 26 – Conduits - Conduit Fastenings and Conduit Fittings, and as indicated on the Drawings.

.4 Install cable exposed, securely supported by straps/clamps, secured in spacing intervals as required by the code.

## 3.5 Installation of Control Cables

.1 Install control cables in conduit, cable troughs, or by direct burial as indicated on the Drawings.

.2 Ground control cable shield.

## 3.6 Cable Identification Tags

.1 The cables shall have identification tags (at conduit entrances and splices) and at equipment terminations indicating feeder number and routing (Example: Routing: "To MH-36", "To SW0893-1B". Feeder: "3501"). The tags shall be 1 inch (25 mm) polypropylene plastic affixed to cables with plastic or nylon ties.

.2 At underground riser poles where feeders make a transition from underground to overhead, the feeder number will be 2 inch x 2 inch (50.8 mm x 50.8 mm) adhesive-backed numbers. These numbers shall be attached to an aluminum strip nailed to wood or banded to steel pole above the cable terminator bracket.

**END OF SECTION**

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

## 1. GENERAL

### 1.1 Work Included

.1 Supply and install all hangers, supports and inserts for the installation shown on the Drawings and specified herein, as necessary to fasten electrical equipment securely to the building structure.

### 1.2 Waste Management and Disposal

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

## 2. PRODUCTS

### 2.1 Framing and Support System

.1 Materials:

.1 Intermediate duty supporting structures shall employ 41 mm square strut channel together with the Manufacturer's connecting components and fasteners for a complete system.

.2 Heavy duty supporting structures to be fabricated and welded from steel structural members and prime painted before installation.

.3 Shall be rated for use in hazardous locations and category environments as necessary.

.2 Finishes:

.1 Hot dipped galvanized.

.2 Nuts, bolts, machine screws: cadmium plated.

.3 Square strut channel:

.1 Section 41 mm square strut channel or as required for load and span, with mounting screws, or approved. 41 mm square strut channel is a minimum standard for supporting conduits 50 mm and larger.

## 3. EXECUTION

### 3.1 General

.1 Do not cut or drill beams, joists or structural steel unless written permission of the Department Representative is obtained.

.2 Distance between conduit or cable supports not to exceed code requirements.

.3 Supports to be suitable for the real loads imposed by equipment.

.4 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over a 1 m span and 8 mm over a 2 m span.

.5 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with Manufacturer's installation recommendations.

.6 Provide rack with 25% spare capacity for multiple runs.

.7 Provide channel support with fittings for vertical runs of conduit and cables.

**3.2 Installation**

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 Use plastic anchors for light loads only. Use metal anchors for all other loads.

.9 Use round or pan head screws for fastening straps, boxes, etc.

.10 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with a minimum of four (4) 6 mm fasteners.

.11 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.12 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.13 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.14 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Department Representative.

.15 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with Manufacturer's installation recommendations.

**END OF SECTION**

# SPLITTERS, JUNCTION BOXES, PULL BOXES AND CABINETS

## 1. GENERAL

### 1.1 Work Included

.1 Provide a complete system of splitters boxes and cabinets for the installation of wiring and equipment.

### 1.2 Shop Drawings and Product Data

.1 Submit Shop Drawings in accordance with Section 01 00 00 – General Requirements and product data for cabinets.

.2 Provide Manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

## 2. PRODUCTS

### 2.1 Splitters

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: Main and branch lugs or connection blocks to match required size and number of incoming and outgoing conductors as indicated.

### 2.2 Splitters, Junction Boxes, Cabinets, and Pull Boxes – Outdoor, Wet locations, Category 2 or Weatherproof

.1 NEMA 4X Rated.

.2 Materials:

.1 PVC.

### 2.3 Splitters, Junction Boxes, Cabinets, and Pull Boxes – Indoor Dry Locations, Category 1

.1 NEMA 1.

.2 Materials:

.1 Code gauge sheet steel, welded construction, phosphatized and factory paint finish.

.3 Components:

.1 For flush mounting, covers to overlap box by 25 mm minimum all around with flush head cover retaining screws.

.2 Use rolled edges for surface boxes.

.4 Junction boxes mounted in exterior walls shall be complete with box vapour barriers.

## 3. EXECUTION

### 3.1 Splitter Installation

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

### 3.2 Junction Boxes and Pull Boxes Installation

.1 Supply all pull boxes and junction boxes shown on the Drawings or required for the installation.

.2 Boxes installed in party walls to be offset by a minimum of one stud space.

.3 Install in inconspicuous but accessible locations, above removable ceilings or in electrical rooms, utility rooms or storage areas.

.4 Identify with system name and circuit designation as applicable.

.5 Size in accordance with the Canadian Electrical Code, as a minimum.

.6 Terminate cables and conductors as required.

.7 Make all necessary cable entry holes in junction boxes supplied by Contractor or others, regardless of material.

### 3.3 Identification

.1 Provide equipment identification in accordance with Section 26 05 00.

**END OF SECTION**

# OUTLET BOXES, CONDUIT BOXES AND FITTINGS

## 1. GENERAL

### 1.1 Work Included

.1 Provide a complete system of boxes for the installation of wiring and equipment.

### 1.2 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations

## 2. PRODUCTS

### 2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CEC.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

### 2.2 Outlet Boxes for Metal Conduit

.1 Materials

.1 Surface mounting exposed: cast ferrous for threaded conduit, with attached lugs, two coats corrosion resistant finish.

.2 Components

.1 Ceiling outlets, surface mounting:

.1 Cast outlet boxes suitable for rigid conduit.

.2 Crouse-Hinds VXF/VFT series.

.2 Wall outlets, surface, exposed mounting or used for outdoor outlets: one or more gang, Crouse-Hinds FS series or FD series, Condulet.

.3 Covers: unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.

**2.3 Conduit Boxes**

.1 Cast FS or FD Feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

**2.4 Fittings - General**

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

**3. EXECUTION**

**3.1 Installation**

.1 NEMA/CSA Type of boxes refer to Division 26.

.2 Support boxes independently of connecting conduits.

.3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Install all outlets flush and surface mounted as required for the installation.

.6 Surface mount above suspended ceilings, or in unfinished areas.

.7 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.

.8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.9 Use plaster rings to correct depth. Use 30 mm on concrete block.

.10 Do not use sectional boxes.

.11 Provide boxes sized as required by the Canadian Electrical Code.

.12 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.

.13 Outlets installed in partition walls to be offset by a minimum of one stud space.

.14 Primary bushings in termination box for cable connection.

.15 Secondary bushings in termination box for bus duct connection.

.16 Control junction box.

**END OF SECTION**

# CONDUITS, CONDUIT FASTENERS AND CONDUIT FITTINGS

## 1. GENERAL

### 1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 18.1 Metallic Outlet Boxes.

.2 CSA C22.2 No. 18.2 Non-metallic Outlet Boxes.

.3 CSA C22.2 No. 18.3 Conduit, Tubing, and Cable Fittings.

.4 CSA C22.2 No. 18.4 Hardware for the Support of Conduit, Tubing, and Cable.

.5 CSA C22.2 No. 18.5 Positioning Devices.

.6 CSA C22.2 No. 45.1 Electrical Rigid Metal Conduit – Steel.

.7 CSA C22.2 No. 45.2 Electrical Rigid Metal Conduit — Aluminum, Red Brass, and Stainless Steel.

.8 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.9 CSA C22.2 No. 83, Electrical Metallic Tubing.

.10 CSA C22.2 No. 227.3, Mechanical Protection Tubing (MPT) and fittings.

### 1.2 Product Data

.1 Submit product data in accordance with Division 26.

## 2. PRODUCTS

### 2.1 Conduits

.1 Rigid metal conduit: to CSA C22.2 No. 45.2, aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45.1, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.

### 2.2 Conduit Fastenings

.1 One-hole stainless steel straps to secure surface conduits 50 mm and smaller.

.1 Two-hole stainless steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1 m on centre.

.4 Threaded stainless steel rods, 9 mm diameter, to support suspended channels.

**2.3 Conduit Fittings**

.1 Fittings: to CSA C22.2 No. 18.3, No. 18.4, and No. 18.5, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

**2.4 Fish Cord**

.1 Polypropylene.

**3. EXECUTION**

**3.1 Installation**

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

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Use epoxy coated conduit underground, in concrete, and in Category 2 locations.

.4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

.5 Use explosion proof flexible connection for connection to explosion proof motors.

.6 Minimum conduit size for lighting and power circuits: 19 mm.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Install fish cord in empty conduits.

.9 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

**3.2 Surface Conduits**

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface mounted aluminum channels.

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

**3.3 Concealed Conduits**

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

**3.4 Conduits in Cast-In-Place Concrete**

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

**3.5 Conduits Underground**

.1 Slope conduits to provide drainage.

**END OF SECTION**

**HEAT TRACING**

## 1. GENERAL

### 1.1 Summary

.1 Provide heat tracing as indicated and in compliance with Contract Documents.

.2 Section Includes:

.1 Self-regulating heat tapes and control equipment.

### 1.2 References

.2 Institute of Electrical and Electronics Engineers (IEEE):

.1 IEEE 844.2/CSA C293.2.

.3 National Electrical Manufacturers Association (NEMA):

.1 250 - Enclosures for Electrical Equipment (1000 volts maximum)

### 1.3 System Description

.1 Design Requirements:

.1 Provide pipe tracing cable system capable of maintaining pipe contents at temperature of 4 degrees Celsius when outside ambient temperature is -29 degrees Celsius with 32 Km/hr wind.

### 1.4 Submittals

.1 Submit the following shop drawings in accordance with Section 01 33 00.

.2 Product Data:

.1 Manufacturer's product data sheets.

.3 Shop Drawings:

.1 Show isometric layout of pipe tracing cables over piping layout.

.2 Include installation details and connection diagrams sufficient to install pipe tracing cable system.

.3 The Contractor shall have Shop Drawing Submissions prepared for all aspects of the work relating to the design and construction of heat trace cables and/or controllers. The Shop Drawing Submission shall be in sufficient detail to permit review of materials for compliance with this Specification and facilitate assembly in the field complete with all necessary connection details.

**1.5 Quality Assurance**

.1 Comply with the requirements specified in Section 01 43 00.

.2 Items provided under this section shall be

.3 Regulatory Requirements:

.1 Electrical Code: Components and installation shall comply with .

**2. PRODUCTS**

**2.1 Manufacturers**

**2.2 Cable Design**

.1 Voltage: 240 volts, 60 Hertz, single phase as shown on Drawings for electrical connection.

.2 Parallel design, current flow across cable.

.3 Heat output 3.96 w/ft (13 w/m) constant, independent of length.

.4 Capable of overlapping without creation of hot spots.

.5 Cut to any length in field.

.6 Self-regulating heat output.

.7 Braided metallic shield.

.8 Outer plastic jacket.

.9 The cable shall be CSA Certified for use on plastic pipe and the manufacturer will be required to provide documentation of same.

.1 Subject to the above, the cable for watermain pipe shall be:

.1 C13-240-COJ thermo-cable as manufactured by Urecon Ltd., supplied complete with grounding braid and FEP grade Teflon overjacket, or approved equal.

**2.3 Controls**

.1 Thermostatic ambient sensing control on each tape set at 4 degrees C.

.1 Provide non-adjustable thermostats, calibrated and tested at factory to operate pipe heating system when temperature of pipe drops to 4 degrees C.

.2 Provide non-adjustable thermostats, calibrated and tested at factory to close alarm contacts when temperature of pipe drops to 2 degrees C at coldest location.

.3 Thermostats to have repeatability and maximum temperature differential of 1 degrees C.

.4 Provide thermostats with NEMA 4 enclosures or as required to suit environment.

.2 Provide proper fittings and appurtenances for field connection of system to conduit and wiring without need for procurement of special fittings or wiring devices.

.3 Heat tracing requirements are defined in Schedule 26 05 95-1.

## 2.4 Controllers

.1 Controllers for services shall be of a type employing solid state circuitry suitable for use with RTD type temperature sensors. Controllers in the Contract are intended for control of the heat trace cable on the pre-insulated piping, at the locations noted on the Construction Drawings. Controllers shall conform to the following design features:

.1 Suitable for control of the cable specified for use on plastic pipe.

.2 Control sensor setpoint: 39.2$^{o}$F (4$^{o}$C)

.3 Hi-temperature cut out: 84.2$^{o}$F (29$^{o}$C)

.4 Circuit Breaker: 30A, 2 pole, single throw for 152 mm watermain, 15A, 1 pole for 25 mm water service, and 15A, 1 pole for 32 mm sewer line.

.5 RTD Sensors:

.1 1 for activation/deactivation
.2 1 high temperature cut-off thermistor

.6 Indicator lights: 3, Power on, heater on, High Temp alarm trip

.7 Enclosure: NEMA 4, weatherproof

.8 Entry holes for wiring:

.1 2 x 1" top and bottom: power in, heater out
.2 1 x 1/2" on the side for sensors

.9 Software and pushbutton for 48-hour manual bypass

.10 Must be CSA approved and meet all applicable Electrical Codes

.2 Electrical Fittings

.1 Electrical fittings such as splice kits, end seals, etc. shall conform to the product supplied by the manufacturer of the heat trace cable and shall conform to the applicable CSA Standards for manufacture and installation.

## 3. EXECUTION

### 3.1 Examination

.1 Examine areas and conditions under which pipe tracing cables to be installed and notify Department Representative, in writing, of conditions detrimental to proper and timely completion of Work.

### 3.2 Installation

.1 Install in accordance with manufacturer's written instructions.

.2 Coordinate circuit connection points and voltages with Drawings.

.3 Apply "electrically traced" signs to outside of thermal insulation as latest CEC Section 62.

.4 Provide circuit breakers in panelboards for heat trace branch circuits.

.5 Install heat trace cable as noted on Construction Drawings.

.6 Install heat tracing cable according to circuit length and geometry on approved Shop Drawings. Installation of cable shall conform to the manufacturer’s instructions and the applicable requirements of the Canadian Electrical Code (CEC). Under no circumstances should the length of pull exceed the maximum recommended by the manufacturer.

.7 Written approval of the manufacturer shall be provided in regard to the installation and testing (as outlined herein) of all heat trace cable.

.8 Splicing, branching and terminating of heating cable shall be performed using approved specialized heat shrink kits specifically designed for that purpose and meeting the requirements of the manufacturer.

.9 Install approved end seal kits at cable circuit ends as per the manufacturer’s instructions.

.10 On/off sensors shall be installed on services during construction. Location of sensor must be identified on Shop Drawing submission and consistent with detail drawing of typical hook-up. Must be installed at location representative of ambient temperature on circuit. Location of sensor on pipe should be 180 degrees from heat trace cable (i.e. opposite side of pipe).

.11 Heat trace cable and electrical appurtenances shall be installed in such a manner as to maintain the integrity of and prevent damage to the water pipe, insulation, and the cable itself and its appurtenances.

.12 To facilitate future connections, the Contractor is to provide sufficient length of heat trace cable and thermistor wire in his installations to enable a complete and functional connection.

### 3.3 Field Quality Control

.1 Examine material for defects prior to installation.

.2 Examine final installation for damage and defects in workmanship prior to start-up and installation of insulation.

.3 Prior to installation of insulation, start pipe tracing system and check for temperature increase over full length of each tracing cable.

### 3.4 Closeout Activities

.1 Provide in accordance with Section 01 77 00.

### 3.5 Schedules

.1 Heat tracing requirements is presented in Schedule 26 05 95-1.

**SCHEDULE 26 05 95-1 HEAT TRACE APPLICATIONS**

| Application | Process Fluid | Maintained Temperature | Insulation (Thickness/Material) | Flow Rate |
|---|---|---|---|---|
| Clean Water | Liquid | 4 C | 3 Inch, Foam | [0.03-USgpm] |
| | | | | |

### 3.6 Testing

.1 A representative of the manufacturer shall megger each circuit of sufficient voltage to confirm whether the circuit will function in its intended manner and is without deficiency. All tests to be witnessed by the Department Representative. Each circuit shall be tested before, during and after installation, and the results recorded.

.2 Should the resistance drop be in excess of that recommended by the manufacturer of the cable, the Contractor shall determine the cause, rectify same, and re-test the circuit.

.3 Records for the Heat Trace Installation

.1 The Contractor shall provide the Department Representative the following records with respect to the construction of the heat trace system and its related controllers:

.1 A Record Drawing of the completed installation showing the location of all terminations, splices, etc. in sufficient detail and accuracy for the Departmental Representative to locate these features in the future. All terminations, splices, etc. shall be tied to a readily identifiable surface feature such as a hydrant, valve, or building face.

.2 A record of each circuit in the heat trace system complete with the appropriate data on circuit length, cable type, and tabulated results of all megger testing.

.3 Submit Operation Manual prepared by the manufacturer(s) of the heat trace system and controls complete with detailed literature on components installed and recommended Operation and Maintenance procedures for the system

**END OF SECTION**

# WIRING DEVICES

## 1. GENERAL

### 1.1 Work Included

.1 Provide and connect all wiring devices for the complete installation.

### 1.2 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 00 00 – General Requirements.

.2 Product data: submit Manufacturer's printed product literature, specifications and datasheets.

.1 Submit manufacturing data.

## 2. PRODUCTS

### 2.1 Manufacturer

.1 Wiring devices to be of one manufacture throughout project.

.1 Acceptable manufacturers:

.1 URECON

.2 Other manufacturers: submit for approval by Department Representative.

### 2.2 Devices

.1 Catalogue numbers shown are for particular Manufacturer's series and all necessary suffixes to be added for requirements as stated. All devices to be specification grade minimum and wherever possible be of same manufacture.

.2 Outdoor areas shall use NEMA 4X boxes and cover plates.

## 3. EXECUTION

### 3.1 Installation

.1 Protect cover plate finish with paper or plastic film until all painting and other work is finished, then remove paper.

.2 Wherever possible, mount equipment in straight line at uniform mounting height, coordinated with other equipment and materials.

.3 Mounting dimensions are to centre of devices. Final instructions on mounting heights to be given by Department Representative. Above to be used as a guide but be subject to final verification prior to installation.

**END OF SECTION**

# TESTING, ADJUSTING AND BALANCING OF ELECTRICAL EQUIPMENT AND SYSTEMS

## 1. GENERAL

### 1.1 Intent

.1 Except where otherwise specified, arrange and pay for testing, adjusting, balancing and related requirements specified herein.

.2 If test results do not conform with applicable requirements, repair, replace, adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.3 Provide all labour, materials, instruments and equipment necessary to perform the tests specified.

.4 All tests shall be witnessed by persons designated by Canada, who shall also sign the test documentation.

.5 Submit procedures proposed in writing for approval two (2) weeks prior to test.

### 1.2 Related Sections

.1 Section 26 05 00 - Common Work Results for Electrical.

### 1.3 Reference Documents

.1 Perform tests in accordance with:

.1 Applicable CSA, IEEE, IPCEA, EEMAC and ASTM standards.

.2 The Contract Documents.

.3 Requirements of Authorities Having Jurisdiction.

.4 Manufacturer's published instructions

.2 If requirements of any of the foregoing conflict, notify the Department Representative before proceeding with test and obtain clarification.

### 1.4 Manufacturer’s Site Services

.1 Arrange and pay for the site services of appropriately qualified Manufacturer's Representatives where site testing, adjusting, or balancing of electrical equipment or systems' performed by Manufacturer's Representatives is:

.1 Specified, or

.2 Otherwise required to ensure that electrical equipment and systems are operational in full compliance with the Manufacturer’s requirements and Contract Documents.

### 1.5 Sequencing and Scheduling

.1 Except where otherwise specified, perform all testing, adjusting, balancing and related requirements specified herein prior to Interim Acceptance of the Work.

.2 Perform voltage testing and adjusting after user occupancy or utilization of facility.

## 2. PRODUCTS

.1 Provide all equipment and tools necessary to perform testing, adjusting and balancing specified herein and as otherwise required during and at the conclusion of project.

.2 Record all data and submit test results for Department Representative's review.

.3 If any found during test, repair defective work, replace defective components, perform required field adjustments and corrective action prior retesting.

.4 Keep records for all tests performed.

## 3. EXECUTION

### 3.1 Testing of Wiring and Wiring Devices

.1 Test all wiring devices for correct operation.

.2 Insulation resistance testing: Megger circuits, feeders and equipment up to 350 V with a 500 Vdc instrument and 600 V with a 1000 Vdc instrument.

.1 Fill out forms appended to this Section and submit to the Department Representative.

.3 Test all heat trace controllers for proper polarity and circuitry.

### 3.2 Power Distribution System including Phasing, Voltage, Grounding and Load Balancing

.1 Circuits originating from branch distribution panels.

### 3.3 Voltage Testing and Adjusting

.1 Test voltage at all panelboards.

.2 Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by the Department Representative.

**END OF SECTION**

# A. Wire and Cable Resistance Test Data Form

Wire or Cable No.: _____ Temperature, °C_____

| Location of Test | Insulation Resistance (megohms) |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |

CERTIFIED_____ Date_____
Contractor's Representative

WITNESSED_____ Date_____
Corporation’s Representative

# B. Cable Insulation Resistance Test Report

| CLIENT: | | | | | | | REF. NO.: |
|---|---|---|---|---|---|---|---|
| LOCATION: | | | | | | | DATE: |
| APPROX. TEST TEMP.: | | | | TEST VOLTAGE: | | | ENGR.: |
| CABLE IDENTIFICATION: | PHASE TO GROUND | | | PHASE TO PHASE | | | REMARKS: |
| | A | B | C | AB | BC | CA | |
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| NOTES: | | | | | | | |
| 1. All readings in megohms unless otherwise noted. | | | | | | | |
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**GRADING**

## 1. GENERAL

### 1.1 Work Included

.1 The following list generally describes the scope of this Section:

.1 Levelling existing areas

.2 Rough grading

### 1.2 Related Work

| | | |
|---|---|---|
| .1 | Excavating, Trenching and Backfilling | Section 31 23 33 |
| .2 | Planting | Section 32 90 10 |

### 1.3 Site Conditions

.1 Known underground and surface utility lines and buried objects are indicated on site plan.

### 1.4 Protection

.1 Prevent damage to building, landscaping, bench marks, surface or underground utility and infrastructure lines which are to remain. Repair any damage.

### 1.5 Surface Restoration

.1 Unless otherwise specified, the Contractor shall be responsible for all surface restoration equal to the original condition.

.2 The Contractor shall make himself fully aware of the conditions in the work area prior to submitting his Tender as no separate payment will be made for any work required as per this item.

.3 Arrangements shall be made by the Contractor with the Authority concerned regarding restoration or surfaces, where such surface restoration is not specifically detailed herein. The Contractor shall bear the full expense involved in replacing the surfaces to the satisfaction of the Authority having jurisdiction.

.4 It shall be the Contractor's responsibility to maintain all surfaces over the pipe trench, including pavement, boulevards, curbs, sidewalks, culverts, etc., to the satisfaction of the Authorities until permanent repairs have been made.

.5 All ditches shall be graded and restored upon completion of the installation. Ditch grades shall be as determined by the Department Representative or by the Authority having jurisdiction over the roadway. The Contractor will also be responsible to maintain the drainage of

## 2. PRODUCTS

### 2.1 Common Backfill

.1 Unless otherwise noted, use suitable excavated material from the site, as identified for use on the drawings. No brush, roots, peat, topsoil, sod, or other perishable or unsuitable material shall be used for common backfill.

## 3. EXECUTION

### 3.1 Grading

.1 Rough grade to levels, profiles and contours allowing for surface treatment as indicated.

.2 Rough grade to finish grade in all areas.

.3 Slope rough grade as indicated.

.4 Moisture content of fill and existing surface to be approximately the same to facilitate bonding.

.5 Compact filled and disturbed areas to Standard Proctor Maximum Dry Density to ASTM D698-91 (latest version) as follows:

.1 Minimum **90%** under landscaped areas

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

.7 Any stockpiles of exposed soil and spoil materials from construction activities will be deposited, whether temporarily or permanently, at least 40 m from the lake edge, and in such a manner that does not allow direct runoff into the lake.

### 3.2 Testing

.1 Inspection and testing of soil compaction will be carried out by the Department Representative.

.2 Costs of test will be paid by Canada.

### 3.3 Surplus Material

.1 Dispose of surplus material from site.

.2 Dispose of material unsuitable for fill, grading or landscaping from site.

**END OF SECTION**

**EXCAVATING, TRENCHING AND BACKFILLING**

## 1. GENERAL

### 1.1 Related Work

| | | |
|---|---|---|
| .1 | Health and Safety Requirements. | Section 01 35 29 |
| .2 | Water Utilities | Section 33 10 00 |
| .3 | Sanitary Sewerage Utilities | Section 33 30 00 |

### 1.2 Definitions

.1 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.2 Topsoil: organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

### 1.3 Protection of Existing Features

.1 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are based on previous records. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify Department Representative, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities where necessary by careful test excavations.

.4 Maintain and protect from damage, water, sewer, electric, telephone and other utilities and structures encountered as indicated. Consult with Department Representative prior to moving or disturbing existing utilities or structure.

.5 Record location of maintained, re-routed and abandoned underground lines

.2 Existing buildings and surface features:

.1 Conduct, with Department Representative, condition survey of existing buildings, trees and other plants, fencing, sheds, service poles, wires, survey benchmarks and monuments which may be affected by work.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

.3 Where excavation necessitates root or branch cutting, do so in a manner that will not cause permanent damage to the tree.

### 1.4 Samples

.1 At least 2 weeks prior to commencing work, submit to Department Representative samples of the materials proposed for use for bedding and initial backfill.

.2 Submit 25 kg of representative samples of each material.

.3 Ship samples prepaid to Department Representative, in tightly closed containers to prevent contamination.

.4 Shipped samples shall be marked clearly with:

.1 Project Name

.2 Intended use of material with applicable specification reference.

## 2. PRODUCTS

### 2.1 Materials

.1 Bedding and Initial Backfill: Bedding and initial backfilling material shall be clean and free running. Under freezing conditions only dry material shall be used. Bedding and initial backfill shall conform to the requirements of CAN 3-A23.1-M77.

.1 Bedding and Initial Backfill material shall conform to the following grading requirements:

| Canadian Metric Sieve Size | Percent of Total Dry Weight Passing |
|---|---|
| 10 000 | 100% |
| 5 000 | 90% - 100% |
| 630 | 25% - 60% |
| 80 | 0% - 3% |

.1 Screening of sand bedding material may be required to eliminate oversize material.

.2 Class 4 Backfill: Selected native material from excavation or other sources, approved by Department Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Modified Class 4 Backfill: Initial backfill layer 1.5 m depth from top of sand bedding to be Class 4 backfill as described in 2.1.2.

.4 Remaining backfill may be modified and may consist of maximum 150 mm rock fragments, blended with native backfill under the following provisions:

.1 Fragments must be distributed uniformly throughout backfill.

.2 Fragments must be less than 25% by volume of backfill material.

.5 Class 2 Backfill: Granular Material shall consist of sound, hard, pit run or crushed rock or crushed gravel and shall be free from organic or soft material which would disintegrate through

decay or weathering. The granular material to be supplied by the Contractor shall be well graded throughout and shall conform to the following grading requirements:

| Canadian Metric Sieve Size | Percent of Total Dry Weight Passing |
|---|---|
| 75 000 | 100% |
| 25 000 | 80 – 100% |
| 5 000 | 40 – 70% |
| 2 000 | 25 – 50% |
| 315 | 10 – 35% |
| 80 | 5 – 30% |

.1 The material passing the 315-micrometre sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than six (6).

.6 The use of backfill specified in .2 and .3 above is subject to prior approval of the Department Representative. It is the intent to use modified backfill only in areas of extreme bouldery excavation conditions.

.7 Use of Modified Class 4 Backfill shall be at no additional cost to the project. The Contractor will be paid as Class 4.

## 3. EXECUTION

### 3.1 Site Preparation

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

### 3.2 Stockpiling

.1 Stockpile fill materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Stockpile materials at a location satisfactory to the Department Representative and at locations that will neither endanger the work or unnecessarily obstruct pedestrian or vehicular access.

### 3.3 Dewatering

.1 Keep excavations free of water while work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

.3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.

.4 All costs associated with dewatering shall be considered incidental to the project and no payment shall be made.

### 3.4 Excavation

.1 Advise Department Representative in advance of excavation operations to enable original cross sections to be taken.

.2 Excavate to required lines, grades, elevations and dimensions as directed by Department Representative.

.3 Dispose of surplus and unsuitable excavated material off site as directed by Department Representative.

.4 Do not obstruct flow of surface drainage or natural water courses.

.5 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.6 Notify Department Representative when soil at bottom of excavation appears unsuitable and additional excavation may be warranted.

.7 Remove unsuitable material from trench bottom to extent and depth necessary to permit adequate foundation for pipe or structure support as directed by Department Representative.

.8 Over-excavation shall be filled with Class 2 backfill compacted to minimum of 95% of the Maximum Dry Density as determined by the Standard Proctor Compaction Test ASTM D698.

.9 Obtain Department Representative 's approval of completed excavation.

### 3.5 Backfill Types and Compaction

.1 Use fill of types as indicated or specified below.

.1 Class 2: **90%** of the Standard Proctor Maximum Dry Density in accordance with ASTM D698. Backfill in layers not exceeding 200 mm. Use Class 2 backfill only where directed.

.2 Class 4: Backfill in layers not exceeding 300 mm. Class 4 material shall be native material, compacted by mechanical means to a density equivalent to the surrounding unexcavated material. Compaction by means of a backhoe bucket is not an acceptable means of mechanical compaction.

### 3.6 Backfilling

.1 Do not proceed with backfilling operations until Department Representative has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground.

.3 In areas of bedrock excavation, the Contractor shall be responsible to provide sufficient backfill material. Importing of backfill material may be required. No separate payment shall be made for this work, it shall be considered incidental to the cost of rock excavation.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Backfilling around installations.

.1 Place bedding and initial backfill as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.6 All areas requiring fill to achieve proper cover and access shall be backfilled with common backfill. Should the Contractor require borrow to achieve proper results, he shall do so at his own cost. No additional measurement will be considered for fill of these areas as it will be considered incidental for both watermain and sewer installations.

## 3.7 Restoration

.1 Upon completion of work, remove surplus materials and debris, and correct defects noted by Department Representative.

.2 Reinstate all surface features to condition and elevation which existed before excavation, unless otherwise specified on Construction Drawings or elsewhere within these Specifications.

.3 Re-instate drainage ditches and any other areas affected by the work as directed by Department Representative.

**END OF SECTION**

**PLANTING**

## 1. GENERAL

### 1.1 Work Included

.1 The work shall include the supply and installation of all materials, preparation of seed bed and harrowing after seeding is completed to areas noted on the drawings or areas disturbed by the execution of the work as decided by the Department Representative.

### 1.2 Related Work

| | | |
|---|---|---|
| .1 | Planting | Section 32 90 10 |
| .2 | Excavating, Trenching and Backfilling | Section 31 23 33 |

## 2. PRODUCTS

### 2.1 Grass Seed

.1 Grass seed shall be Canada No. 1 Grade seed mixed as follows:

.1 30% Crested Wheatgrass

.2 25% Creeping Red fescue

.3 15% Fiesta II Perennial ryegrass

.4 15% Victory Chewing fescue

.5 15% Range lander alfalfa

.6 Seed available at PickSeed, Contact: Telephone (204) 633-0088; Fax (204) 694-1690.

## 3. EXECUTION

### 3.1 Seed Bed

.1 The seed bed shall be tilled and harrowed to provide a firm, soft seed bed immediately prior to seeding and harrowed again after seeding is completed.

### 3.2 Seeding

.1 The grass seed shall be sown at a depth not greater than 25 mm (one inch) by a seed drill or approved alternate method. Seeding shall be done in early fall or spring. All seeded areas shall be thoroughly watered within 24 hours after placing. No seeding shall be done on frozen soils or when unfavourable seeding conditions exist.

### 3.3 Rate of Application

.1 Grass seed shall be sown and shall be spread at the following rates:

.1 Grass Seed - 55 kg/ha

### 3.4 Maintenance

.1 The Contractor shall be responsible for the maintenance of the seeded areas for a period of thirty (30) days after the completion of seeding operations.

.2 Any damage which may occur through washout of the soil during the maintenance period shall be repaired by the end of this period. The Contractor shall water all seeded areas as necessary to supplement rainfall to ensure a total of 25 mm of water per week. Additional water application may be required in July and August or during a dry and hot period to ensure successful establishment.

### 3.5 Rock Garden

.1 No replanting is required in the rock garden east of the rail station. The Contractor shall prepare the seed bed as specified and replace the existing rocks similar to the existing conditions.

**END OF SECTION**

## 1. GENERAL

### 1.1 Description

.1 This Specification shall cover all phases of the construction of watermains, water services, and related appurtenances.

.2 The work to be done by the Contractor under this Section shall include the supply of all materials and the furnishing of all superintendence, overhead, labour, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

### 1.2 Related Work

| | | |
|---|---|---|
| .1 | Excavation, Trenching and Backfilling | Section 31 23 33 |
| .2 | Cast-in-Place Concrete | Section 03 30 00 |
| .3 | Heat Tracing | Section 26 05 95 |

### 1.3 Samples

.1 At least 2 weeks prior to commencing work, submit representative samples of bedding and initial backfill material as per Section 31 23 33.

### 1.4 Materials

.1 Supply, Handling and Storage of Materials

.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials shall be handled and stored in a careful manner, in accordance with the manufacturer's recommendations and to the satisfaction of the Department Representative.

.2 Testing and Approval

.1 All materials supplied under this Specification shall be subject to inspection and testing by the Department Representative or by the Testing Laboratory designated by the Department Representative. There shall be no charge to Canada for any materials required by the Department Representative for testing purposes.

.2 Any materials that, in whole or in part, do not conform to the Specification detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be replaced by the Contractor at his expense.

### 1.5 Scheduling of Work

.1 Develop schedule of work to minimize interruptions to existing services. Provide temporary services as required.

## 2. PRODUCTS

### 2.1 Watermain Pipe and Fittings

.1 Pipe shall be:

.1 High density: Polyethylene pipe (HDPE) conforming to:

.1 American Water Works Association (AWWA) Standard C906.

.2 ASTM F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR), based on outside diameter, Iron Pipe Size (IPS).

.3 Pipe to be made from polyethylene resin compound with a minimum cell classification of PE 445574C for PE 4710 materials in accordance with ASTM D3350. Material to have a Long Term Hydrostatic Strength of 11 MPa when tested and analyzed by ASTM D2837. Resin to have a minimum hydrostatic design stress of 1000 psi @73 F and shall be a Plastic Pipe Institute (PPI) TR 4 listed compound.

.4 Pipe to be FM rated.

.5 Polyethylene piping to be thermal butt fusion welded. Flanged connections at fitting locations unless otherwise specified by Department Representative. Flanged connections to AWWA-C110 with Class 150 cast iron or ductile iron backing flanges and rubber gasket cut to fit the joint.

.6 PE pipe shall be evaluated and certified as safe for transport of potable water as outlined in Section 2 of AWWA C906 and NSF 61 certified.

.2 Pre-insulate watermain as per Clause 2.12 of this Section.

.2 Fittings

.1 Cast Iron Fittings

.1 Flanged fittings conforming to AWWA Standard C110 complete with cement mortar lining to ANSI A21.4, Class 250 with ends to suit type of pipe specified.

.2 Polyethylene Fittings

.1 Used in conjunction with PE pipe.

.2 Manufactured in accordance with same specifications as the PE pipe and shall be the same series and resin as the pipe with which the appurtenance is used.

.3 Fittings shall be of an equivalent dimension ratio (EDR) as the pipe. The average wall thickness shall be 25% greater than that of the pipe. Where butt-fused, ends shall have the same wall thickness as the pipe.

.4 Fittings shall be FM rated.

.3 Fittings to be pre-insulated as per Clause 2.12 of this Section.

## 2.2 Encasement Pipe

.1 Encasement pipe for the watermain shall be:

.1 450 mm (18”) diameter conforming to ASTM A53 GR B

.2 Minimum thickness: 9.5 mm (3/8”)

.3 Minimum yield strength: 241 MPa

.4 Joints: N/A, one section of pipe only

.5 Coating: N/A

.6 Spacers: Ranger II – Midi with 44 mm (1.75”) runner height as manufactured by GPT (an EnPro Industries company) or approved equivalent.

.7 Spacing: 2.4 m (8’) maximum spacing between spacers, 0.6 m (2’) maximum from ends.

## 2.3 Valves and Valve Boxes

.1 Gate Valves: to AWWA C509, with O-ring stem seals, non rising spindle, with flange to flange joint for HDPE joints. Gate valves are to be equipped with a 50 mm square operating nut.

.1 Valves to operate as counter-clockwise to open operation.

.2 Gate valves shall be ULC listed and FM approved.

.3 The following gate valves will be considered approved for use. One brand for the project will be allowed to be installed.

.1 McAvity

.2 Canada Valve

.3 Mueller

.4 Clow

.5 American AVK Co.

.2 Gate valves are to be insulated as specified for watermains and as shown on the detail drawings.

.3 Valve boxes: Bituminous coated ductile iron sliding upper casing section, adjustable over a minimum of 450 mm complete with valve operating extension rod, 22 x 22 m cross section, of such length that when set on valve operating nut, top of rod will be from 150 mm - 450 mm below cover. Stone disc required. Top of box to be marked "W", be lockable and shall be hinged. Lower section to be DR18 PVC as manufactured by IPEX, Royal Flex, or equal.

.4 Buried nuts and bolts to be 316 stainless steel, as per Clause 2.7 of this Specification.

.5 Miscellaneous valve and valve box materials shall conform to the detail drawings.

## 2.4 Service Connections

.1 Water Service Pipe and Carrier Pipe: High Density Polyethylene (HDPE) Pipe

.1 Conforming to AWWA C901 and CSA 137.1.

.2 25 mm service pipe to be CARAPACE (SIDR-9) 200 PSI NSF STD 14 polyethylene as manufactured by Heat-Line (supplied by others).

.3 75 mm casing pipe to be DR 17, Series 100, pre-insulated as per Clause 2.12.

.4 Where directed, pipe trench to be insulated with rigid insulation.

.2 Joints: to be thermal butt or socket fusion welded.

.3 Electrofusion self-tapping tees and integral main stop to be pre-insulated.

.4 Bronze key-type curb stops: Curb stops shall be bronze, with no drain and compression type outlets. Mueller H15207/H15217, Ford Ball Valves B44.444, or approved equal. Curb stops to have bituminous coated, cast iron service box (adjustable upper section) with a ribbed lid, five-sided nut (22 mm flat to point), 16 mm 304 stainless steel rod, a yoke to fit curb stops, and a brass cotter pin centered on the yoke. Mueller A-714 service box c/w PVC frost stop (Urecon or approved equal).

.5 All compression connections require stainless steel stiffener as recommended by manufacturer of HDPE pipe.

.6 Bottom of all service boxes to be pre-insulated as per details on Drawings.

## 2.5 Hydrants (On-Line)

.1 Post type hydrants: Conform to AWWA C502, designed for working pressure of 1 MPa with two 65 mm threaded hose outlets and one 114 mm pumper hose outlet (complete with caps and chains), minimum 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main. Hydrants to operate as a clockwise to open operation. Threads to Town of Churchill standards. Depth of bury as indicated on the drawings.

.1 Pre-insulate hydrants as specified for watermains and as shown on the Detail Drawings.

.2 Colour hydrants red.

.3 All nuts and bolts below grade shall be as per Clause 2.7 of this Section.

.4 Hydrants shall be fitted with a 19 mm thick duck reinforced phenolic resin insulating flange between the base and the lower barrel.

.5 The following hydrants will be considered approved for use:

.1 Canada Valve as manufactured by Mueller Canada

.2 Mueller Modern Centurion, as manufactured by Mueller Canada

.3 McAvity M67 Brigadier, as manufactured by Clow

.4 or approved equal

.6 Hydrants to be ULC listed and FM approved.

.7 Hydrants to be non-drain type, with “No Drain” imprinted on barrel.

.8 One brand for the project will be allowed to be installed.

**2.6 Pipe Bedding Materials**

.1 Granular materials, general.

.1 As per Clause 2.1 in Section 31 23 33.

.2 Concrete required for thrust blocks, and other watermain installations as per Section 03 30 00.

**2.7 Bolts**

.1 All Stainless-Steel nuts and bolts below grade, used in the assembly of watermain, including hydrants, valves, and flanges, shall be Type 316 to ANSI 303 and ASTM 320.

**2.8 Pipeline Warning Tape**

.1 Yellow colour coded marking tape with printed warning "CAUTION: BURIED PIPELINE LINE BELOW" as manufactured by Lineguard Inc. or approved equal. This item is considered incidental to pipeline installation.

.2 Install only one tape per trench configuration, regardless of the number of pipes installed. This is not intended to be used for service connections.

**2.9 Tools and Equipment**

.1 Provide the following to Canada:

.1 Two hydrant wrenches.

.2 Two tee-handle operating key valves.

**2.10 Fittings & Specials**

.1 All fasteners shall be stainless steel.

.2 Plugs shall be of a type employing stainless steel tie-rods or all stainless-steel strapping as a means of thrust restraint.

.3 Couplings for connections to existing watermains shall be "Romac", "Robar", "Smith-Blair Inc.", “Mueller Viking Johnson Couplings” with 316SS bolts, or approved equal suitable for the

type, size and class of watermain encountered and as supported by manufacturer. All couplings shall be supplied complete with a fusion bonded epoxy coating and lining as per Section 3 of AWWA Standard C213.

.1 All connections to be fused bonded unless approved by the Department Representative.

.2 For compression connections on HDPE pipe, use an approved stainless-steel insert.

.4 Where insulation of fittings and specials is noted on the Drawings, they shall be insulated by either of the following methods:

.1 Pre-insulated by coating the fitting with a 75 mm thickness of rigid polyurethane foam.

.1 The urethane foam shall then be coated with either mastic or a 2.54 mm thick fibre-reinforced polyester jacket (FRP) and allowed to cure as recommended by the manufacturer. Where a mastic coating is applied, the mastic shall exhibit the following physical properties:

| | |
|---|---|
| Colour | Black |
| Solids by Volume | 62% (approximately) |
| Coverage | 14 litres per 9.3 $m^2$ (3 gals. per 100 $ft^2$) |
| Drying Time to Touch | 4 hours |
| Drying Time Firm | 48 hours |
| Service Temperature | -29°C to 93°C |
| Min. Application Temp. | 4.4°C (40°F) |
| Moisture Permeability | 3.2 mm (1/8 in) |
| Wet Film at 37.7°C (100°F) | |
| 90% R.H. ASTM E-96 | 02 Perms |
| Shelf Life | 12 Months |

.2 Heat shrink tape shall then be field applied to complete the jacketing of the fitting.

.2 Field insulated with prefabricated insulating kits consisting of rigid polyurethane foam encased with a fibreglass reinforced polyester jacket or an extruded high-density polyethylene jacket. The ends shall be sealed to ensure that the insulation is watertight.

## 2.11 Corrosion Protection

.1 All buried and exposed iron surfaces (i.e. any iron surface that is not pre-insulated) shall be wrapped for corrosion protection with 0.20 mm (8 mil) thick polyethylene sheet as per AWWA Standard C105.

## 2.12 Insulation

.1 Watermain and 75 mm water service carrier piping shall be pre-insulated with minimum 75 mm nominal thickness of factory applied rigid polyurethane foam and an outer jacket of 50 mils minimum thickness HDPE with UV inhibitor. Pre-insulation of watermains shall be Urecon Ltd. or approved equal. Insulation to have the following material properties:

.1 Density: 35 to 46 $kg/m^3$

.2 Closed Cell Content: 90% minimum

.3 Water Absorption: 4.0% by volume

.4 Thermal Conductivity: 0.020 to 0.026 W/m $^{o}$C

.5 Outer jacket to have the following properties:

.1 Jacket Material: polyethylene UV inhibited, specially formulated for superior cold environment properties.

.2 Sealant: butyl rubber and resin.

.3 Jacket Thickness: 1.27 mm.

.4 Minimum Elongation: 300%, 6-month test.

.5 Service Temperature Range: installation at -34$^{o}$ to 71$^{o}$ C; in service at -45$^{o}$ to 85$^{o}$ C.

.6 Tensile Strength: 6.83 kg/cm wide.

.6 Insulated pipe joints shall be completed with the use of prefabricated urethane half shells or moulded in place with the use of “Portafoam” portable urethane kits. The joints shall be completed with the application of a suitable wrap around adhesive lined heat shrink sleeve as supplied by the manufacturer of the pre-insulation. Heat shrink sleeves shall overlap the insulation jacket by a minimum of 75 mm on either side of the joint.

.7 Insulation kits for fittings shall consist of a rigid polyisocyanurate foam (Dow Trymer 9501, Elliot Elfoam T-20 or approved equal) with a fully bonded Polymer protective coating on all interior and exterior surfaces, including end faces. Kits are to be supplied complete with silicone caulking for seams, stainless steel attachment straps and clips, and heat shrink sleeves to seal between the pipe and the insulation kit.

.8 Insulation kits to be designed, manufactured, and supplied by pipe insulation manufacturer. Where pipe insulation manufacturer does not design and manufacture insulation kits, submit shop drawings to show compatibility of insulation kits with pipe and fitting pre-insulation. Insulation kits requiring adjustment/cutting in the field, other than for special applications, shall be rejected.

.9 Insulation kits have the following material properties:

.1 Rigid Polyisocyanurate or Urethane Foam Insulation

.1 Density: 27 to 32 kg/m$^{3}$
.2 Compressive Strength: 131 to 158 kPa
.3 Closed Cell Content: 90% minimum
.4 Water Absorption: 4.0% by volume
.5 Thermal Conductivity: 0.027 W/m $^{o}$C
.6 Thickness: to match pipe insulation thickness

.2 Polymer Coating, Urecon BL-75-20EP (or approved equal)

.1 Two component high density polyurethane coating, black in colour.
.2 Density: 1170 kg/m$^3$
.3 Durometer D scale 60
.4 Tensile Strength: 11,100 kPa
.5 Tear Strength: 26.5 N/mm
.6 Thickness: 1.9 mm outside surfaces, 0.51 mm inside surfaces

## 2.13 Identification Band

.1 All insulated watermains shall have a factory-applied, exterior spirally wound colour band 25 mm in width. Spiral interval shall be approximately 1.0 m, Urecon Model #URWATDES-248-B or equal (blue in colour).

## 2.14 Heat Trace Cable and Controllers

.1 Heat Trace Cable

.1 Heat trace cable shall be:

.1 Parallel resistance, constant watt output cable suitable for use on plastic pipe and cutting to length in the field. The cable shall be CSA Certified for use on plastic pipe and the manufacturer will be required to provide documentation of same.

.1 Subject to the above, the cable for watermain pipe shall be:
.1 C13-240-COJ thermocable as manufactured by Urecon Ltd., supplied complete with grounding braid and FEP grade Teflon overjacket, or approved equal.

.2 The cable for owner supplied water service pipe shall be:
.1 120V GFC model, comes installed with 25 mm CARAPACE water service pipe as manufactured by Heat-Line.

.2 Refer to Section 26 05 95.

.2 Controllers

.1 Refer to Section 26 05 95.

.3 Electrical Fittings

.1 Refer to Section 26 05 95.

## 2.15 Owner Supplied Materials

.1 25 mm water service pipe, CARAPACE (SIDR-9) 200 PSI NSF STD 14 polyethylene as manufactured by Heat-Line (c/w heat tracing cable).

## 3. EXECUTION

### 3.1 Preparation

.1 Clean pipes, fittings, valves, hydrants and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

### 3.2 Trenching and Backfill

.1 Do trenching and backfill work to Section 31 23 33.

### 3.3 Pipe Bedding and Initial Backfill

.1 Place bedding materials to full trench width and specified thickness as noted on details.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior.

.3 Shape transverse depressions in bedding as required to make joints.

.4 Compact for full width of trench and ensure pipe is uniformly supported throughout its length.

.5 Fill any excavation below level of bottom of specified bedding (i.e. over-excavation, whether inadvertent or due to the removal of unsuitable material) with granular material in maximum 150 mm lifts compacted to 90% of Standard Proctor.

.6 Ensure sufficient cover on pipe to permit backfilling without damage being caused to pipe or initial backfill.

### 3.4 Pipe Installation

.1 Lay pipes as per the manufacturer's instructions such that when completed pipe has smooth and uniform invert.

.2 Ensure compliance with manufacturer Manual of Practice.

.3 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead to open end of last pipe laid to prevent entry of foreign materials.

.4 Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.

.5 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.6 Join HDPE pipe by thermal butt fusion methods. Provide trained personnel and fusion machine suitable for type of pipe utilized. Provide certification from manufacturer of pipe that joining equipment is suitable for type of pipe used and the operator is qualified to operate same.

.7 Recheck HDPE pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.8 Do not lay pipe on frozen bedding.

.9 Protect hydrants against freezing during the course of the work.

## 3.5 Valve Installation

.1 Install new valves on new watermains to manufacturer's recommendations at locations indicated on the Construction Drawings.

.2 Support valves as per manufacturer’s recommendations.

## 3.6 Service Connections

.1 Install service connections prior to hydrostatic and leakage testing of water main.

.2 Install water service pipe inside pre-insulated 75 mm HDPE DR17 carrier pipe.

.3 Construct service connections at right angles to watermain unless otherwise directed. Install curb stops and curb stop boxes as per drawings and specification or at locations identified by the Department Representative.

.4 Install and close temporary shut-off valve(s) on end of pressure water pipe, as required.

.5 Employ only competent workers equipped with suitable tools to carry out connection to mains, cutting and jointing of pipes.

.6 Install single and multiple tap service connections on top half of main, between 0 degrees and 30 degrees measured from springline of pipe.

.7 Install multiple electrofusion tapping tees and main stop a minimum of 30 degrees apart around circumference of pipe and a minimum of 450 mm apart along pipe.

.8 Leave electrofusion tapping tee fully open, unless otherwise instructed.

.9 Install service connection insulation kit as noted on the Detail Drawing.

.10 Install curb stop with curb stop box on service 50 mm or less in diameter. Equip larger services with a gate valve and cast-iron box. Set box plumb over stop and adjust top valves fully closed.

.11 Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.12 Where service connections are made to existing pre-insulated watermains repair damage to existing insulation with "Port-O-Foam" Polyurethane Foam insulation kit and wrap with heat shrink tape.

### 3.7 Hydrant Assemblies

.1 Install hydrant assemblies at location indicated or directed.

.2 Install hydrant assemblies in accordance with AWWA Manual of Practice M-17.

.3 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway or as directed and with body flange set at an elevation within 50 mm - 150 mm above final grade.

.4 Place concrete thrust blocks and support blocks as indicated on the Construction Drawings.

.5 Ensure that drain holes are plugged.

.6 Paint “No Drain” on body of hydrant in stencilled white letters 50 mm high unless manufacturer has placed a permanent “no drain” tag.

### 3.8 Thrust Blocks

.1 Do concrete work to Section 03 30 00.

.2 Place concrete thrust blocks between fittings (tees, plugs, caps and bends), and undisturbed ground as indicated. Install bond-breaker of 0.20 mm (8 mil) thick polyethylene sheet between concrete and fittings.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

### 3.9 Rail Undercrossing

.1 Coordinate all work with Hudson Bay Railway company and comply with all railway company requirements, schedules and safety procedures.

.2 Excavate in accordance with Section 31 23 33. Install casing by either of the two following methods:

.1 Remove a complete section of rail complete with ties at bolted connection points. Cutting rail will no be permitted. Reinstalling the complete section following completion of backfilling.

.2 Support and suspend the rail and hand tunnel/excavate material beneath the rail to install the casing pipe.

.3 Backfill beneath the track shall be Class 2 backfill as specified in Section 31 23 33, except shall be compacted to 100% standard proctor density.

.4 Supply and install new ballast and grade rail to within 5mm of original elevation with no sharp or uneven dips or humps. Repair any settlement that occurs during the warranty period immediately after being notified by the Department Representative or railway company.

.5 Install new pre-insulated watermain in casing pipe supported by casing spacers as indicated on the drawings. Seal the watermain to casing by

## 3.10 Hydrostatic and Leakage Testing of New Watermains

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Department Representative at least 24 hours in advance of all proposed tests. Perform all tests in presence of Department Representative.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until concrete is of sufficient strength to withstand thrust forces.

.4 Test pipeline in sections not exceeding 365 m in length. Longer test sections will be permitted upon application to the Department Representative and provided the allowable leakage is calculated based on a 365 m length.

.5 Operate all valves before and after test and confirm hydrostatic integrity.

.6 Hydrostatic and leakage testing for PE pipe:

.1 Test pressure shall be as follows at the lowest elevation of the system

.1 1.00 Mpa (150 psi) for DR11 pipelines.

.2 0.69 MPa (100 psi) for DR17 pipelines.

.2 Fill system slowly with water and bleed off air by tapping high points or installing temporary bleeder valves. Ensure existing water supply is protected against inadvertent contamination by utilizing approved backflow prevention devices. At the completion of the test, remove valves and suitable taps plus add sufficient makeup water to the system at hourly intervals for 3 hours to return to the test pressure in order to accommodate pipe expansion. Maintain test pressure and commence test 1 hour later (i.e. 4 hours after initially pressurizing pipe).

.3 Add sufficient makeup water to commence test period at test pressure. Test period to be a minimum of 1 hour and not greater than 3 hours.

.4 After test period, add measured amount of makeup water to return to the test pressure. Amount of makeup water shall not exceed the allowance given in the following table.

.5 Total time under test must not exceed 8 hours.

.6 "Relax" test section for 8 hours prior to the next testing sequence if test not successful.

.7 Allowance for Expansion During Test Period

| Nominal Pipe Size (mm) | Allowance for Expansion Litres/100 Metres of Pipe | | |
|---|---|---|---|
| | 1 Hour Test | 2 Hour Test | 3 Hour Test |
| 100 | 1.61 | 3.10 | 4.97 |
| 150 | 3.72 | 7.45 | 11.18 |
| 200 | 6.21 | 12.42 | 18.63 |
| 250 | 8.69 | 16.15 | 26.08 |
| 300 | 13.66 | 28.56 | 42.23 |

.8 These allowances are based on the temperature of the pipe being 73.4° F (23°C). Should the ambient temperature (or the temperature of the water) be substantially different the manufacturer of the pipe shall supply sufficient data to apply an appropriate correction factor to these allowances.

.9 Locate and repair defects if leakage observed or if expansion is greater than allowance specified.

.10 Repeat hydrostatic test until all defects have been corrected and are confirmed corrected by successful hydrostatic test.

**3.11 Flushing and Disinfecting of New Watermains**

.1 Flushing and disinfecting operations shall be witnessed by Department Representative. Notify Department Representative at least 24 hours in advance of proposed date when disinfecting operations will commence.

.2 Carry out flushing and disinfection as per AWWA Standard C651, Section 5.2, the Continuous Feed Method.

.3 Flush watermains thoroughly through available outlets (eg. hydrant nozzle) and/or tapped outlets at sufficient rate to produce a minimum velocity of 0.75 m/s (2.5 fps) within watermain for sufficient time period to remove all foreign material. Flushed water must be clear.

.4 Minimum flushing requirements are as follows:

| Pipe Size NPS | Flushing Flow (L/s) | Tapped Outlets (With Up to 6 m of Discharge Pipe) | Hydrant Requirements (63 mm No. 27 LGS) |
|---|---|---|---|
| 150 and below | 15 | 1-50 mm | 1 |
| 200 | 25 | 2-50 mm | 1 |
| 250 | 38 | 2-50 mm | 1 |
| 300 | 53 | 3-50 mm | 2 |

.5 Provide connections and pumps as required.

.6 When flushing has been completed, introduce a strong solution of chlorine into watermain and ensure that it is distributed throughout entire system. Only use a chlorine solution feed type of chlorinator. The initial chlorine solution into the line shall have a free chlorine residual not less than 25 mg/L, nor greater than 75 mg/L.

.7 The watermain containing chlorine solution shall be isolated and left for 24 hours. The required minimum chlorine residual after 24 hours is 10 mg/L free available chlorine.

.8 At the end of the required retention period, the watermain shall be flushed until the chlorine residual is equal to the residual of the normal water supply and in no case exceed 2 mg/L.

.9 After flushing, the Contractor shall take bacteriological samples in duplicate and submit to the Health Authority for analysis. Sampling shall be witnessed by the Department Representative.

.10 Upon receipt of results that indicate the complete absence of Total Coliform organisms (i.e. < 1) in all of the samples, the Department Representative shall make the necessary arrangements to permit the main to be put in service.

.11 If any of the samples are positive, flush, re-chlorinate, and carry out additional testing as necessary and until such time that the absence of Total Coliform can be confirmed by testing in triplicate.

**3.12 Connection of New Watermains to Existing Watermains**

.1 Connect new watermains to existing watermains at locations shown on the Construction Drawings.

.2 Connect to existing watermain with the appropriate connectors for type of watermain pipe.

.3 Insulate connection as specified within this Section and repair any damage to existing insulation.

**3.13 Heat Trace Cable**

.1 Refer to Section 26 05 95.

.2 Install heat trace cable as noted on Construction Drawings.

.3 Heat trace cable and electrical appurtenances shall be installed in such a manner as to maintain the integrity of and prevent damage to the water pipe, insulation, and the cable itself and its appurtenances.

.4 To facilitate future connections, the Contractor is to provide sufficient length of heat trace cable and thermistor wire in his installations to enable a complete and functional connection.

**3.14 Line and Grade**

.1 The pipe shall be installed to the line and grade shown on the Drawings and as laid out in the field by the Department Representative. Vertical variance from grade shall not exceed 50 mm and horizontal variance from line shall not exceed 100 mm. Sharp bends will not be permitted even though the pipe remains within these tolerances. Tees and bends shall be installed to the grades and the locations shown on the plans or where required to connect to existing

watermains. **Electronic grade control shall be used throughout the duration of pipe installation.**

**END OF SECTION**

**SANITARY SEWERAGE UTILITIES**

## 1. GENERAL

### 1.1 Description

.1 This Specification shall cover the supply and placement of sanitary sewer mains, sewer services and related appurtenances, all as specified or shown on the Drawings.

.2 The work to be done by the Contractor under this section shall include the furnishing of all superintendence, overhead, labour, materials, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all work as shown on the Drawings and hereinafter specified.

### 1.2 Related Work

| | | |
|---|---|---|
| .1 | Excavation, Trenching & Backfilling | Section 31 23 33 |
| .2 | Cast-in-Place Concrete | Section 03 30 00 |
| .3 | Heat Tracing | Section 26 05 95 |

### 1.3 Samples

.1 At least two weeks prior to commencing work, submit representative samples of bedding and initial backfill material as per Section 31 23 33.

### 1.4 Materials

.1 Supply, Handling and Storage of Materials

.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials shall be handled and stored in a careful manner, in accordance with the manufacturer's recommendations and in a manner that will prevent damage or degradation of the material.

.2 Testing and Approval

.1 All materials supplied under this Specification shall be subject to inspection and testing by the Department Representative or by the Testing Laboratory designated by the Department Representative. There shall be no charge to Canada for any materials required by the Department Representative for testing purposes.

.2 All materials shall be approved by the Department Representative before any construction is undertaken. If, in the opinion of the Department Representative, such materials, in whole or in part, do not conform to the Specification detailed herein or are found to be defective in manufacture or have become damaged in transit, storage or handling operations, then such material shall be rejected by the Department Representative and replaced by the Contractor at his expense.

### 1.5 Scheduling of Work

.1 Develop schedule of work to minimize interruptions to existing services. Provide temporary services as required.

## 2. PRODUCTS

### 2.1 Wastewater Sewer Service Pipe

.1 Wastewater Service Pipe and Carrier Pipe: High Density Polyethylene (HDPE) Pipe

.1 Conforming to AWWA C901 and CSA 137.1.

.2 32 mm service pipe to be CARAPACE (SIDR-9) 200 PSI NSF STD 14 polyethylene as provided by Heat-Line (supplied by others).

.3 75 mm carrier pipe to be DR 17, Series 100, pre-insulated as per Clause 2.5.

.4 Where directed, pipe trench to be insulated with rigid insulation.

### 2.2 Wastewater Sewer Fittings

.1 All fittings and accessories shall be manufactured and furnished by the pipe supplier. Service connections to sewer mains or manholes shall be made using a pre-fabricated tee or junction pipe.

.2 Where pre-insulation of fittings and specials is noted on the Drawings, they shall be insulated by either of the following methods:

.1 Pre-insulated by coating the fitting with a 75 mm thickness of rigid polyurethane foam.

.1 The urethane foam shall then be coated with either mastic of a 2.54 mm thick fibre-reinforced polyester jacket (FRP) and allowed to cure as recommended by the manufacturer. Where a mastic coating is applied, the mastic shall exhibit the following physical properties:

| | |
|---|---|
| Colour | Black |
| Solids by Volume | 62% (approximately) |
| Coverage | 14 litres per 9.3 $m^2$ (3 gals. per 100 $ft^2$) |
| Drying Time to Touch | 4 hours |
| Drying Time Firm | 48 hours |
| Service Temperature | -29°C to 93°C |
| Min. Application Temperature | 4.4°C (40°F) |
| Moisture Permeability Wet Film at 37.7°C (100°F) 90% R.H. ASTM E-9602 Perms | 3.2 mm (1/8 in.) |
| Shelf Life | 12 Months |

.2 Heat shrink tape shall then be field applied to complete the jacketing of the fitting.

.2 Field insulated with prefabricated insulating kits consisting of rigid polyurethane foam encased with a fibreglass reinforced polyester jacket or an extruded high-density polyethylene jacket. The ends shall be sealed to ensure that the insulation is watertight.

## 2.3 Cement Mortar

.1 Portland Cement: to CAN3-A5-M77 (sulphate-resistant).

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

## 2.4 Pipe Bedding Material

.1 Granular Materials, General

.1 As per Sub-Section 2.1 in Section 31 23 33.

## 2.5 Insulation

.1 Wastewater sewer services shall be pre-insulated with minimum 75 mm nominal thickness of rigid polyurethane foam and an outer jacket of 50 mils minimum thickness HDPE with UV inhibitor. Pre-insulation shall be by the U.I.P. process as supplied by Urecon Ltd. or approved equal.

.1 Insulated pipe joints shall be completed with the use of prefabricated urethane half shells or moulded in place with the use of “Portafoam” portable urethane kits. The joints shall be completed with the application of a suitable wrap around adhesive lined heat shrink sleeve as supplied by the manufacturer of the pre-insulation. Heat shrink sleeves shall overlap the insulation jacket by a minimum of 75 mm on either side of the joint.

.2 Insulation kits for fittings shall consist of a rigid polyisocyanurate foam (Dow Trymer 9501, Elliot Elfoam T-20 or approved equal) with a fully bonded Polymer protective coating on all interior and exterior surfaces, including end faces. Kits are to be supplied complete with silicone caulking for seams, stainless steel attachment straps and clips, and heat shrink sleeves to seal between the pipe and the insulation kit.

.2 Rigid Box Insulation

.1 Rigid box insulation installed in the trench shall conform to CGSB 51-GP-20M Type 4, extruded polystyrene foam as manufactured by Dow Chemical (Dow HI40 Styrofoam), Celfort Foamular 400 or approved equal. The insulation shall have a minimum compressive strength of 275 kPa.

## 2.6 Identification Band

.1 All insulated sewer mains and service piping shall have a factory applied exterior spirally-wound colour band 25 mm in width. Spiral interval shall be approximately 1.0 m, Urecon Model #URWATDES-246-B or equal (brown in colour).

### 2.7 Pipeline Warning Tape

.1 Yellow colour coded marking tape with printed warning “CAUTION: BURIED PIPELINE LINE BELOW” as manufactured by Lineguard Inc. or approved equal. This item is considered incidental to pipeline installation.

.2 Install only one tape per trench configuration, regardless of the number of pipes installed. This is not intended to be used for service connections.

### 2.8 Heat Trace Cable

.1 Heat trace cable shall be:

.1 Parallel resistance, constant watt output cable suitable for use on plastic pipe and cutting to length in the field. The cable shall be CSA Certified for use on plastic pipe and the manufacturer will be required to provide documentation of same.

.1 The cable for owner supplied sewer service pipe shall be:

.1 120V GFC model, comes installed with 32 mm CARAPACE sewer service pipe as provided by Heat-Line.

.2 Refer to Section 26 05 95.

### 2.9 Owner Supplied Materials

.1 32 mm sewer service pipe, CARAPACE (SIDR-9) 200 PSI NSF STD 14 polyethylene as provided by Heat-Line (c/w heat trace cable).

## 3. EXECUTION

### 3.1 Preparation

.1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

### 3.2 Trenching and Backfill

.1 Do trenching and backfill work in accordance with Section 31 23 33.

### 3.3 Pipe Bedding and Initial Backfill

.1 Place bedding materials to full trench width as noted on details.

.2 Shape bed true to grade to provide continuous, uniform bearing surface for pipe exterior.

.3 Shape transverse depressions in bedding as required to make joints.

.4 Thoroughly compact full width of trench and ensure pipe is uniformly supported throughout its length and for full depth of pipe embedment.

.5 Fill any excavation below level of bottom of specified bedding (i.e. over-excavation) with granular material in maximum 150 mm lifts compacted to 90% of Standard Proctor.

.6 Ensure sufficient cover on pipe permit backfilling without damage being caused to pipe or initial backfill.

### 3.4 Wastewater Sewer Service Installation

.1 Install pipe to most recent CSA standards and manufacturer's standard instructions and specifications.

.2 Install wastewater sewer service pipe inside pre-insulated 75 mm HDPE DR17 carrier pipe.

.3 Maintain minimum grade for sewers services unless otherwise approved by the Department Representative.

### 3.5 Connections of PVC/PE Pipe to Manholes

.1 Where PVC/PE pipe is required to be connected to existing or proposed manholes, ensure a watertight connection. At the entrance to manholes, coat pipe end with an approved cementing agent to which sand has been added and allowed to harden, prior to grouting the pipe into the manhole so that a suitable watertight bond is obtained between PVC/PE pipe and the concrete.

.2 A pre-treated PVC/PE gasketed "horsecollar" manhole insert conforming generally to the above and providing a watertight bond and joint, shall be considered approved.

### 3.6 Heat Trace Cable

.1 Refer to Section 26 05 95.

.2 Install heat trace cable as noted on Construction Drawings.

.3 Heat trace cable and electrical appurtenances shall be installed in such a manner as to maintain the integrity of and prevent damage to the water pipe, insulation, and the cable itself and its appurtenances.

.4 To facilitate future connections, the Contractor is to provide sufficient length of heat trace cable and thermistor wire in his installations to enable a complete and functional connection.

### 3.7 Line and Grade

.1 Sewer pipe shall be installed to the line and grade shown on the drawings and as set in the field by the Department Representative. Vertical variance from grade shall not exceed the following limits: the invert of the pipe shall not be more than 50 mm below the design grade nor more than 25 mm above the design grade and there shall be no dips which will allow ponding of water to a depth of more than 50 mm. Horizontal variance from line shall not exceed 100 mm. Sharp bends will not be permitted even though the sewer pipe remains within these tolerances. Electronic grade control shall be used throughout the duration of pipe installation.

.2 Manholes, tees, wyes, reducers and bends shall be installed to the grades and at the locations shown on the drawings. The allowable tolerance from the line and grade shall not exceed those specified for sewer pipe.

**END OF SECTION**