

**Part 1            General**

**1.1                ADMINISTRATIVE**

- .1        Submit to Contract Administrator submittals listed for review in accordance with the Specifications, or as requested by the Contract Administrator.
- .2        Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
  - .1        Allow 10 Working Days for review of submittals by the Contract Administrator.
- .3        Do not proceed with Work affected by submittal until review is complete.
- .4        Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5        Where items or information is not produced in SI Metric units converted values are acceptable.
- .6        Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .7        Notify Contract Administrator, in writing at time of submission for review, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8        Verify:
  - .1        Field measurements
  - .2        Field construction criteria
  - .3        Catalogue numbers and similar data
  - .4        Ensure affected adjacent Work is co-ordinated.
- .9        Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .10       Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .11       Acceptance of Shop Drawings for a component or a subassembly does not constitute acceptance of the complete assembly of which it is a part.
- .12       The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.

- .13 After Contract Administrator's review and return of copies, distribute copies to sub-trades as appropriate.
- .14 Keep one reviewed copy of each submission on site.

## **1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, weights, dimensions, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the 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 Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.
- .3 Have Shop Drawings stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba where required in the Specifications or by the Contract Administrator.
- .4 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract Documents.
- .5 Submittals shall be in one of the following formats:
  - .1 Submit one electronic PDF copy.
- .6 Shop Drawing reviews by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.
- .7 Shop Drawings will be returned to the Contractor with one of the following notations:
  - .1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.
  - .2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".
  - .3 When stamped "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 EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS", or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.
- .8 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.
- .9 Any adjustments made on Shop Drawings by the Contract Administrator 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.
- .10 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.
- .11 Only two (2) reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates. The Contract Administrator's charges for the additional Work will be deducted from the Contractor's Progress Certificates.
- .12 Show the following information in lower right hand corner of shop drawings.
  - .1 Project Title.
  - .2 Tender number or other project number assigned by the Contract Administrator.
  - .3 Name of the depicted item in accordance with the Specifications and Drawings.
  - .4 Project series number and location where the item is used if applicable.
  - .5 Specification section number if applicable
  - .6 Proposed option if applicable.
  - .7 Name of Contractor.
- .13 Accompany submissions with transmittal letter, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Specification Section, Title, Number, and Clause
  - .6 Other pertinent data.
  - .7 Date and revision dates.
  - .8 Project title and Bid Opportunity number.
  - .9 Name of:
    - .1 Contractor
    - .2 Subcontractor
    - .3 Supplier
    - .4 Manufacturer

- .5 Separate detailer when pertinent
- .10 Identification of product of material.
- .11 Relation to adjacent structure or materials.
- .12 Field dimensions, clearly identified as such.
- .13 Specification section name, number and clause number or drawing number and detail/section number.
- .14 Applicable standards, such as CSA or CGSB numbers.
- .15 Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

### **1.3 PROCEDURES**

- .1 The Contractor shall, if required by the Contract Administrator, submit for the review of the Contract Administrator method statements which describe in detail, supplement with Drawings where necessary, the methods to be adopted for executing any portion of Work.
- .2 These statements shall also include details of constructional plant and labour to be employed. Acceptance by the Contract Administrator shall not relieve the Contractor of any of his responsibilities, nor shall reasonable refusal to approve entitle the Contractor to extra payment or an extension of time.
- .3 Other Considerations
  - .1 Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.
  - .2 Material and equipment delivered to the site of the works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.
  - .3 Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.
  - .4 No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not Used.

### **Part 3 Execution**

#### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                INSPECTION**

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

**1.2                INDEPENDENT INSPECTION AGENCIES**

- .1        Independent Inspection/Testing Agencies may be engaged by the City for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the City. Costs of additional tests required due to defective Work shall be paid by the Contractor.
- .2        All equipment required for executing inspection and testing will be provided by the respective agencies.
- .3        Employment of inspection/testing agencies does not relieve or relax responsibility to perform Work in accordance with Contract Documents.
- .4        If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Contract Administrator at no cost to the City. Pay costs for retesting and re-inspection.

**1.3                ACCESS TO WORK**

- .1        The City, the Contract Administrator, and other authorities having jurisdiction shall have access to the work.

**1.4                REJECTED WORK**

- .1        Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with the Contract Documents.
- .2        Make good other Contractor's work damaged by such removals or replacements promptly.

- .3 If in opinion of the Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, the City will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Contract Administrator.

**1.5 REPORTS**

- .1 Submit draft inspection and test reports to Contract Administrator, prior to inclusion with the O&M manuals, in accordance with Section 01 33 00 - Submittal Procedures.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                SUBMITTALS**

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

**1.2                INSTALLATION AND REMOVAL**

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

**1.3                DEWATERING**

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

**1.4                WATER SUPPLY**

- .1        Provide potable water as required for construction use.

**1.5                TEMPORARY HEATING AND VENTILATION**

- .1        Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2        Construction heaters used must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3        Provide temporary heat and ventilation in enclosed areas as required to:
  - .1        Facilitate progress of Work.
  - .2        Protect Work and products against dampness and cold.
  - .3        Prevent moisture condensation on surfaces.
  - .4        Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
  - .5        Provide adequate ventilation to meet health regulations for safe working environment.
- .4        Maintain temperatures of minimum 10 degrees C or higher as needed in areas where construction is in progress.
- .5        Ventilating:
  - .1        Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2        Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3        Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 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.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

## 1.6 TEMPORARY POWER AND LIGHT

- .1 Provide temporary power and light, construction power, lighting, and other requirements during shutdowns. The Flood Pumping / Lift Station are equipped with a high voltage service. The utility service provides 600V power within the Station via the step-down transformers. It is anticipated that the utility service (and thus the 600V distribution) will be unavailable during a brief period when the high voltage services are terminated at the incoming main switchgear and subsequently when the outgoing high voltage cable is routed into the step-down transformer.
- .2 If 600V / 120V / 208V power is required by the Contractor then the Contractor may coordinate with, and pay for temporary power to be brought to the site. Where a temporary 600V service is used, the Contractor is responsible for providing a service entrance rated fusible disconnect switch or circuit breaker, a utility metering enclosure, and the 600V distribution. All costs are to be paid for by the Contractor. As an alternative to a temporary 600V service the Contractor may provide a temporary 600V generator, and all fuel costs are paid for by the Contractor. Provision of 600V power by the Contractor is mandatory during utility de-energization of the site. **It is required that all power outages are kept to an absolute minimum, as these facilities are critical City infrastructure.**
- .3 The existing Station lighting and receptacles may be used for construction requirements. Correct and repair any damage to existing electrical distribution, lighting, and receptacles, caused by use under this Contract.

## 1.7 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.



**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

- .1     Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used (if needed), avenues of ingress/egress to fenced area and details of fence installation.
- .2     Indicate use of supplemental or other staging area.
- .3     Provide construction facilities in order to execute work expeditiously.
- .4     Remove from site all such work after use.

**1.2                SCAFFOLDING**

- .1     Scaffolding in accordance with CAN/CSA-S269.2.
- .2     Provide and maintain scaffolding and ladders as required.

**1.3                HOISTING**

- .1     Provide, operate and maintain any hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2     Hoists to be operated by qualified operator.

**1.4                CONSTRUCTION PARKING**

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

**1.5                EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1     Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2     Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

**1.6                SANITARY FACILITIES**

- .1     Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2     Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

**1.7 OFFICES**

- .1 Provide office heated to 20 degrees C, lighted, and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location at the construction sites.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

**1.8 LAYDOWN AND STORAGE**

- .1 All construction materials shall be stored at designated storage areas. Stored combustible materials shall be separated by clear space to prevent fire spread and allow access for manual fire fighting equipment, including fire hoses, extinguishers, hydrants, etc.
- .2 Ensure equipment is stored in a secure manner.
- .3 Pressurized dry chemical fire extinguishers of suitable capacity or equally effective extinguishers as per NFPA 10 shall be provided where:
  - .1 Flammable liquids are stored or handled.
  - .2 Welding or flame cutting is performed.

**1.9 DISPOSAL OF WASTE MATERIALS**

- .1 Spoiled and waste materials shall not be dumped, under any circumstances, in any locations other than those approved by the local authorities. Any cost for permits and fees for disposing of waste materials shall be at the Contractor's expense.
- .2 Disposal of all excavated and waste materials shall be in accordance with the requirements of the appropriate provincial regulatory agencies.
- .3 When working anywhere within the Works the Contractor shall at the end of each working day remove the rubbish and leave the Site in a clean and tidy state, to the satisfaction of the Contract Administrator. If this is not done, the City will clean the Site and charge the Contractor.

**1.10 WARNINGS AND TRAFFIC SIGNS**

- .1 When Work is performed within public areas, provide and erect adequate warning signs as necessary to give proper warning. Place signs sufficiently in advance to enable public to respond to directions.

**1.11** Provide and maintain signs and other devices required to indicate construction activities or other temporary or unusual conditions resulting from the Work.

**Part 2 Products**

- .1 Not Used.

**Part 3            Execution**

.1            Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Conform to reference standards, in whole or in part as specifically requested in specifications.
- .2        If there is question as to whether products or systems are in conformance with applicable standards, the Contract Administrator reserves the right to have such products or systems tested to prove or disprove conformance.
- .3        Cost for such testing will be born by the City in event of conformance with Contract Documents or by the Contractor in event of non-conformance.

**1.2                QUALITY**

- .1        Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2        Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection. Should disputes arise as to quality or fitness of products, decision rests strictly with the Contract Administrator based upon requirements of Contract Documents.
- .3        Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

**1.3                AVAILABILITY**

- .1        Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2        In event of failure to notify the Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

**1.4                METRIC PROJECT**

- .1        Unless otherwise noted, this project has been designed and is to be constructed in the International System (SI) of Units metric system of measurements.
- .2        During construction, when specified metric elements are unattainable at the time they are required to meet the construction schedule, the Contractor shall notify the Contract

Administrator in writing and suggest alternative substitutions. Costs due to these substitutions shall be borne by the Contractor.

### **1.5 STORAGE, HANDLING AND PROTECTION**

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

### **1.6 TRANSPORTATION**

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

### **1.7 MANUFACTURER'S INSTRUCTIONS**

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

**1.8 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

**1.9 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

**1.10 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent un-authorized access to work areas via fencing of work areas.
- .2 Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of the Contract Administrator.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 WORKMANSHIP**

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

- .2 Do not employ anyone unskilled in their required duties. The Contract Administrator reserves the right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with the Contract Administrator, whose decision is final.

**END OF SECTION**



**Part 1            General**

**1.1                SUBMITTALS**

- .1        Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit written request in advance of cutting or alteration which affects:
  - .1        Structural integrity of elements of project.
  - .2        Integrity of weather-exposed or moisture-resistant elements.
  - .3        Efficiency, maintenance, or safety of operational elements.
  - .4        Visual qualities of sight-exposed elements.
  - .5        Work of the City or separate contractor.
- .3        Include in request:
  - .1        Identification of project.
  - .2        Location and description of affected Work.
  - .3        Statement on necessity for cutting or alteration.
  - .4        Description of proposed Work, and products to be used.
  - .5        Alternatives to cutting and patching.
  - .6        Effect on Work of the City or separate contractor.
  - .7        Written permission of affected separate contractor.
  - .8        Date and time work will be executed.

**1.2                MATERIALS**

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

**1.3                PREPARATION**

- .1        Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2        After uncovering, inspect conditions affecting performance of Work.
- .3        Beginning of cutting or patching means acceptance of existing conditions.
- .4        Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5        Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

**1.4 EXECUTION**

- .1 Remove and replace defective and non-conforming Work.
- .2 Provide openings in non-structural elements of Work for penetrations of electrical Work.
- .3 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .4 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .5 Restore work with new products in accordance with requirements of Contract Documents.
- .6 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .7 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with approved fire stopping material, full thickness of the construction element.
- .8 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                PROJECT CLEANLINESS**

- .1        Maintain work in tidy condition, free from accumulation of waste products and debris, other than that caused by the City or other Contractors.
- .2        Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Contract Administrator. Do not burn waste materials on site.
- .3        Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4        Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5        Provide on-site containers for collection of waste materials and debris.
- .6        Dispose of waste materials and debris off site.
- .7        Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8        Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9        Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10      Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11      Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

**Part 2            Products**

**2.1                NOT USED**

- .1        Not Used.

**Part 3            Execution**

**3.1                NOT USED**

- .1        Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                SUBMITTALS**

- .1        Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Copy will be returned after final inspection, with Contract Administrator's comments.
- .3        Revise content of documents as required prior to final submittal.
- .4        Furnish evidence, if requested, for type, source and quality of products provided.
- .5        Pay costs of transportation.

**1.2                OPERATING AND MAINTENANCE MANUALS**

- .1        Prepare using personnel experienced in maintenance and operation of described products.
- .2        Operation and maintenance instructions and technical data to be sufficiently detailed with respect to design elements, construction features, component function, correct installation procedure and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation. Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.
- .3        One (1) advance copy of the manual shall be submitted prior to Total Performance of the Work for review and comments. After review, five (5) hard copies and one electronic (PDF) copy of the final manuals shall be submitted.
- .4        For the guidance of the City's operating and maintenance personnel, the Contractor shall prepare O&M Manuals for the Work, describing in detail the construction of each part of the Work and the recommended procedure for operation, servicing and maintenance.
- .5        All instructions in these manuals shall be in simple language to guide the City in the proper operating and maintenance of this installation.
- .6        In addition to information called for in the Specifications, include the following:
  - .1        Overall Title sheet, labelled "Operation and Maintenance Instructions", and containing project name and date, facility's covered in the manual, City's Contract number, the name and address of the Contractor, and the issue date.
  - .2        Overall list of contents, indicating the facilities upgraded by the project.
  - .3        Title sheet for each section, labelled "Operation and Maintenance Instructions", the applicable facility, and containing project name and date.
  - .4        List of contents for each section.
  - .5        Include:
    - .1        Brochures/catalogue excerpts of all components of the Work.
    - .2        Documentation of all test results.
    - .3        Complete set of equipment and assembly drawings

- .4 Installation, start-up, O&M Manuals
  - .5 Any specific requirements from the Specifications
  - .6 Clean Shop Drawings and cutsheets of all equipment and materials,
    - .1 Do not utilize the submittals as these may have markups on them and would therefore contain inaccurate information.
  - .7 Include sections for the record drawings of all installations. Drafted record drawings of size 432x279mm (11 x 17") will be inserted by the Contract Administrator, based on the record drawings marked up by the Contractor.
  - .8 Names, addresses, and telephone numbers of all major sub-contractors and suppliers.
- .7 Modify and supplement the manual as required by the Contract Administrator.
- .8 Format to be as follows:
- .1 Binders: vinyl, hard covered, 3 'D' ring, with spine and face pockets.
  - .2 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
  - .3 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

**1.3 AS-BUILT DRAWINGS**

- .1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining Project As-Built Drawings. Accurately record deviations from Contract Documents caused by Site conditions and changes ordered by the Contract Administrator. Update daily.
- .2 Identify Drawings as "Project Record Copy". Maintain in good condition and make available for inspection on-site by Contract Administrator at all times.
- .3 On completion of each facility, submit As-Built Drawings to Contract Administrator for review.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    The City of Winnipeg (CW)
  - .1    CW 2160.
  - .2    CW 3230.
  - .3    CW 3410.
- .2    Canadian Standards Association (CSA)
  - .1    CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
  - .2    CAN/CSA-A23.2, Methods of Test for Concrete.
  - .3    CAN/CSA-A3000-A5, Portland Cement.
  - .4    CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

**1.2                SUBMITTALS**

- .1    Shop Drawings
  - .1    Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.
- .2    Construction Method
  - .1    No work shall commence on construction of concrete work until after the Contract Administrator's review of the Contractor's Construction Method submission.
  - .2    The Contractor shall prepare for the Contract Administrator's review a Construction Method submission detailing:
    - .3    Construction sequence to be followed including all methods to be employed to ensure no damage occurs to existing structures or adjacent properties within or adjacent to the Works.
    - .4    Submission to include proposed method of construction, specialized equipment to be used, and any design revisions proposed to accommodate the Contractor's proposed construction method.
    - .5    The Contractor shall respond to any concerns that may be raised by the Contract Administrator after review of Construction Method submission.

**Part 2            Products**

**2.1                MATERIALS**

- .1    Portland cement: to CAN/CSA-A3000-A5, Type HS or HSb.
- .2    Reinforcing bars: to CAN/CSA-G30.18, Grade 400.
- .3    Premoulded joint filler:
  - .1    Bituminous impregnated fibreboard: to ASTM D1751.

- .4 Joint sealer/filler: to CAN/CGSB-19.24, Type 1, Class B.
- .5 Sealer: proprietary poly-siloxane resin blend.
- .6 Other concrete materials: to CAN/CSA-A23.1.
- .7 Void Form: Frost Cushion as manufactured by Beaver Plastics or approved equal in accordance with B7.

## **2.2 MIXES**

- .1 Proportion concrete in accordance with CAN/CSA-A23.1 and CW 2160.
- .2 Concrete: concrete design shall be in accordance with performance specification and shall have the following properties:
  - .1 Cement: Type HS or HSb.
  - .2 Minimum Compressive Strength @ 28 days: 35 MPa
  - .3 Slump: 80 +/- 20 mm
  - .4 Air Content: 5 – 8% +/- 1%
  - .5 Maximum Water/Cement Ratio = 0.40
- .3 Class of exposure: S-1 to CAN/CSA-A23.1.
- .4 Nominal maximum size of coarse aggregate: 20mm and to CAN/CSA-A23.1.
- .5 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1.
- .6 Admixtures: to CAN/CSA-A23.1.
- .7 Grout: Sika Grout 212 or approved equal in accordance with B7.
- .8 Masonry Fill: concrete design shall be in accordance with performance specification and shall have the following properties:
  - .1 Cement: Type GU.
  - .2 Minimum Compressive Strength @ 28 days: 20 MPa
  - .3 Slump: 200 mm
  - .4 Air Content: nil
  - .5 Maximum Water/Cement Ratio = 0.49
- .9 Bonding Agent: ACRYL-STIX or approved equal in accordance with B7.

## **Part 3 Execution**

### **3.1 GENERAL**

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

- .2 Make neat openings in walls and floor slabs using concrete coring and cutting equipment and methods.
- .3 Fill openings left in concrete after removal of piping or other equipment with watertight, non-shrink grout. Finish new surfaces flush with the existing surface and match the surrounding surface texture. Primer and paint shall be applied in accordance with Section 09 91 23 if the surrounding surfaces have a paint finish.
- .4 Mix and apply grout in accordance with the manufacturer's instructions.
- .5 Mix and apply bonding agent in accordance with the manufacturer's instructions.
- .6 Neatly grout any concrete surface that has been broken and had the aggregate exposed with a smooth finish similar in texture to that of the surrounding concrete.
- .7 Apply concrete bonding agents between new concrete or grout and existing concrete surfaces. Remove all loose, pitted and scaled concrete and apply bonding agent in accordance with the manufacturer's instructions.
- .8 De-scale exposed reinforcing steel and have all rust removed before applying grout.

### **3.2 FORMING**

- .1 Construct formwork and falsework in accordance with CAN/CSA-A23.1 and CSA S269.1.
- .2 Use void form under all grade beams; do not cast grade beams against ground.

### **3.3 INSERTS**

- .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by the Contract Administrator.

### **3.4 FINISHES**

- .1 Formed surfaces exposed to view: sack rubbed finish in accordance with CAN/CSA-A23.1.
- .2 Interior floor slabs: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CAN/CSA-A23.1 to produce hard, smooth, dense trowelled surface free from blemishes.
- .3 Equipment pads: provide smooth trowelled surface. Provide 25mm chamfers at all outer edges.
- .4 Pavements, walks, curbs and exposed site concrete:
  - .1 Screed to plane surfaces and use floats.
  - .2 Provide round edges and joint spacings using standard tools.
  - .3 Trowel smooth to provide lightly brushed non-slip finish.



### **3.5 CONTROL JOINTS**

- .1 Cut form control joints in slabs on grade at locations indicated or to match existing, in accordance with CAN/CSA-A23.1 and install specified joint sealer/filler.

### **3.6 EXPANSION AND ISOLATION JOINTS**

- .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface.

### **3.7 CURING**

- .1 Cure and protect concrete in accordance with CAN/CSA-A23.1.
  - .1 Do not use curing compounds where bond is required by subsequent topping or coating.

### **3.8 SEALING**

- .1 Following curing, apply poly-siloxane resin blend sealer at 4 m<sup>2</sup>/L or approved equal in accordance with B7.

### **3.9 SITE TOLERANCES**

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

### **3.10 QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be in accordance with CSA A23.1 and carried out by a Testing Laboratory designated by the Contract Administrator. Quality control tests for concrete will be used to determine the acceptability of the concrete supplied.
- .2 Provide without charge samples of concrete and constituent materials required for quality control tests and provide assistance and use of tools and construction equipment as is required.
- .3 The frequency and number of concrete quality control tests will be in accordance with the requirements of CSA A23.1.
- .4 Non-destructive methods for testing concrete will be in accordance with CSA A23.2.
- .5 An outline of the quality control testing is as follows.
  - .1 Samples of concrete for test specimens will be taken in accordance with CSA A23.2-1C.
  - .2 Slump tests will be performed in accordance with A23.2-5C. If measured slump falls outside limits specified a second test will be made. In the event of a second failure the Contract Administrator reserves right to refuse the batch of concrete represented.
- .6 Non-destructive methods for testing concrete will be in accordance with CSA A23.2. Air content test will be performed in accordance with CSA A23.2-4C. If measured air content

falls outside limits specified in Table CW 2160.1 a second test will be made at any time within the specified discharge time limit for the mix. In the event of a second failure the Contract Administrator reserves the right to reject the batch of concrete represented.

- .7 Compressive strength test specimens will be taken in accordance with CSA A23.2-3C.
- .8 Compressive strength tests at 28 days will be the basis for acceptance of all concrete supplied. For each 28 day test the strength of two companion standard-cured test specimens will be determined in accordance with CSA A23.2-9C. Test result will be the average strength of both specimens.
- .9 Field Inspection: A minimum of twenty-four (24) hours notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for observation of reinforcing steel.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    City of Winnipeg (CW)
  - .1        CW 2160
- .2    American Concrete Institute (ACI)
  - .1        SP-66, ACI Detailing Manual 2004.
    - .1            ACI 315, Details and Detailing of Concrete Reinforcement.
    - .2            ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .3    CSA International
  - .1        CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2        CSA-A23.3, Design of Concrete Structures.
  - .3        CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
  - .4        CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5        CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .6        CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4    Reinforcing Steel Institute of Canada (RSIC)
  - .1        RSIC, Reinforcing Steel Manual of Standard Practice.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    The Contractor shall submit shop drawings for the Contract Administrator's approval two (2) weeks prior to the fabrication of any reinforcing steel.
- .2    The Contractor shall provide, without charge, the samples of reinforcing steel required for quality control tests and provide such assistance and use of tools and construction equipment as is required.
- .3    Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.
- .4    Shop Drawings:
  - .1        Submit drawings stamped and signed by professional engineer registered in the Province of Manitoba.
    - .1            Indicate placing of reinforcement and:
      - .1                Bar bending details.
      - .2                Lists.
      - .3                Quantities of reinforcement.

- .2 Detail lap lengths and bar development lengths to CSA-A23.3.

### **1.3 QUALITY ASSURANCE**

- .1 Submit:
  - .1 Mill Test Report: Upon request, provide the Contract Administrator with certified copy of mill test report of reinforcing steel a minimum of 4 weeks prior to beginning reinforcing work.
  - .2 Upon request submit in writing to the Contract Administrator the proposed source of reinforcement material to be supplied.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18.
- .2 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
  - .1 Bar accessories shall be of type approved by the Contract Administrator. They shall be made from a non-corroding material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete. Bar chairs are to be PVC; galvanized bar chairs are not acceptable.
  - .2 Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator. Bar accessories are not shown on the Contract Drawings. The supply and installation of bar accessories shall be considered incidental to the supply and placing of reinforcing steel.
- .5 Plain round bars: to CSA-G40.20/G40.21.
- .6 Replace defective or damaged materials with new.

## **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315, CW 2160, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

## **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide the Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform the Contract Administrator of proposed source of material to be supplied.

## **Part 3 Execution**

### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where authorized by the Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

### **3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
  - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain the Contract Administrator's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 A minimum of twenty-four (24) hours notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for observation of reinforcing steel.

### **3.3 CLEANING**

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

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                GENERAL**

- .1        This Section covers items common to Sections of Division 26. This section supplements the requirements of Division 01.

**1.2                CODES AND STANDARDS**

- .1        Do complete installation in accordance with CSA C22.1-2021 except where specified otherwise.
- .2        Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

**1.3                DRAWINGS AND SPECIFICATIONS**

- .1        The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.
- .2        These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.
- .3        Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.
- .4        If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

**1.4                CARE, OPERATION AND START-UP**

- .1        Instruct City maintenance and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2        Where services of a manufacturer's factory service engineer is required, arrange and pay for services to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3        Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

### **1.5 PERMITS, FEES AND INSPECTION**

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

### **1.6 MATERIALS AND EQUIPMENT**

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified. For enclosures to be installed within hazardous locations, Stainless Steel (316) NEMA 4X enclosures shall be used.

### **1.7 ELECTRICAL EQUIPMENT MODIFICATION**

- .1 Where electrical equipment is field modified, arrange for special inspection and pay all associated fees.

### **1.8 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

### **1.9 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates as follows:
  - .2 Nameplates:
    - .1 Lamacoid 3 mm thick plastic lamacoid nameplates, white background, black lettering, mechanically attached with self tapping screws.



#### NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
Size 8	35 x 100 mm	3 lines	5 mm high letters

- .3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.

#### 1.10 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders, branch circuit and control wiring.
  - .1 Wire tags to be heat shrink type with black letters on a white background.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

#### 1.11 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

#### 1.12 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and the Contract Administrator.
- .2 Lamacoid 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20mm text.

#### 1.13 WALL MOUNTED DRAWINGS

- .1 Provide single drawings in plexiglass holder adjacent to the main electrical distribution.
  - .1 Plexiglass holder to be designed for the purpose and allow for easy replacement of the drawing.
  - .2 Size: 432mm x 279mm minimum size.
- .2 Drawings:
  - .1 Mission Flood Pumping Station: 1-0163F-E0001 - Single Line Diagram

- .2 Cornish Flood Pumping Station: 1-0132F-E0001 - Single Line Diagram
- .3 Colony Flood Pumping Station: 1-0128F-E0001 - Single Line Diagram
- .4 Galt Flood Pumping Station: 1-0142F-E0001 - Single Line Diagram

#### **1.14 CONDUIT AND CABLE INSTALLATION**

- .1 Sleeves through concrete: Rigid PVC, sized for free passage of conduit.
- .2 Fire stop opening and weather-proof seal with CSA / ULC approved assembly for the installation conditions.

#### **1.15 CUTTING AND PATCHING**

- .1 Provide all cutting a patching required.
- .2 Return exposed surfaces to an as-found condition.
- .3 Exercise care where cutting holes existing concrete elements so as not to damage existing reinforcing.
  - .1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.
  - .2 For all holes larger than 50 mm passing through reinforced concrete, mark the location of the desired hole and all adjacent rebar. Obtain approval from the Contract Administrator prior to cutting.
  - .3 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

#### **1.16 ANCHOR INSTALLATION**

- .1 The Contractor shall exercise care where installing anchors into existing concrete elements so as not to damage existing reinforcing. All anchors shall be installed utilizing carbide tip drill bits. The existing reinforcing shall be located utilizing a reinforcing bar locator and marked out on the surface of the concrete. The drill holes shall be advanced to the required depth for installation of the anchors. Should reinforcement be encountered while drilling the hole shall be terminated and repositioned to clear the reinforcement. Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling.

#### **1.17 FIELD QUALITY CONTROL**

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

**1.18 TESTING**

- .1 All test instruments utilized are to have been calibrated within one year of the date utilized.
- .2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

**1.19 SUBMITTALS**

- .1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in each Division.
- .2 Submit Shop Drawings (including Product Data) for all equipment and all cabling as required in each Section of this Specification. Include shop drawing submittals for:
  - .1 5 kV Switchgear
  - .2 5 kV cabling
  - .3 Grounding systems
  - .4 Equipment support pads.
- .3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.
- .4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.
- .5 Should Shop Drawing information be insufficient or the Contract Administrator does not approve of the Shop Drawings, the Contractor shall arrange to resubmit Shop Drawings at no additional change to contract price.
- .6 Manufacture of Products shall conform to revised Shop Drawings.

**1.20 AS-BUILT DRAWINGS**

- .1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, site instructions, clarifications, and revisions for the purpose of As-Built Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

**Part 2            Products**

**2.1                NOT USED**

.1                Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            26 05 01 – Common Work Results, Electrical.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA-C22.2 No. 131-07, Type TECK 90 Cable.
- .2            National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)
  - .1            ICEA S-93-639/NEMA WC74-06, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.

**1.3                SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
  - .1            Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1            Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria.

**1.4                DELIVERY, STORAGE AND HANDLING**

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

**Part 2            Products**

**2.1                5/8 kV CABLE**

- .1            Stranded copper conductor(s), size as indicated.
- .2            Extruded Strand Sheild: Extruded thermoset semi-conducting stress-control layer over conductor.
- .3            Insulation: EPR or EPDM:
  - .1            133% insulation level at 5kV
  - .2            100% insulation level at 8kV.

- .4 Extruded Insulation Shield: Thermoset semi-conducting polymeric layer free stripping from insulation.
- .5 Metallic Shield: 5 mil annealed copper tape with an overlap of 25%.
- .6 Jacket: Lead-free, flame-retardant moisture- and sunlight-resistant PVC.
- .7 Temperature rating: 105°C.
- .8 Approvals: CSA or equivalent.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install power cable in ducts as indicated and in accordance with manufacturer's instructions.
- .2 Install power cable in trenches as indicated.
- .3 Provide supports and accessories for installation of high voltage power cable.
- .4 Install stress cones, terminations and splices in accordance with manufacturer's instructions
- .5 Install grounding in accordance with local inspection authority having jurisdiction.
- .6 Provide cable identification tags and identify each phase conductor of power cable.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results for Electrical.
- .2 Use of qualified tradespersons for installation, splicing, termination and testing of high voltage power cables.
- .3 Test high voltage power cable after it is routed. Submit test result and inspection certificate.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2    CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.
- .3    CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.
- .4    CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

**1.2                PRODUCT DATA**

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

**Part 2            Products**

**2.1                BUILDING WIRES**

- .1    Wire: to CAN/CSA-C22.2 No. 38.
- .2    Conductors:
  - .1    Size as indicated. Minimum size: 12 AWG.
  - .2    Stranded for 10 AWG and larger.
  - .3    Tin-Plated Copper conductors.
- .3    Voltage rating:
  - .1    Circuits 480 V and less: 600 V
  - .2    Circuits > 480 V: 1000 V
  - .3    1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90, or TECK90.
- .4    Colour coding to Section 26 05 01, wires sized 2 AWG and smaller to be factory colour coded, taping will not be accepted.

**2.2                TECK CABLE**

- .1    Cable: to CAN/CSA-C22.2 No. 131.
- .2    Conductors:
  - .1    Grounding conductor: Tin-Plated Copper.
  - .2    Circuit conductors: Tin-Plated Copper, size as indicated.
- .3    Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .4    Inner jacket: polyvinyl chloride material.

- .5 Armour: interlocking aluminum.
- .6 Overall covering: polyvinyl chloride material.
- .7 Fastenings:
  - .1 One (1) hole malleable iron / steel straps to secure surface cables 50 mm in diameter and smaller.
  - .2 Two (2) hole steel straps for cables larger than 50 mm in diameter.
  - .3 Channel type supports for two or more cables.
  - .4 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Cable Fittings:
  - .1 Minimum requirement: Watertight, approved for TECK cable.
  - .2 Hazardous Locations:
    - .1 CSA approved.
    - .2 Watertight type with:
      - .1 an elastomeric bevelled bushing.
      - .2 a funnel entry, splined gland nut.
      - .3 a non-magnetic, stainless steel grounding device with dual grounding action.
      - .4 a taper threaded hub.
      - .5 a hexagonal body and gland nut
    - .3 Integral seal type with metal-to-metal contact construction.
    - .4 Sealing of multi-conductor cable shall be accomplished with a liquid type polyurethane compound.
    - .5 The fitting must:
      - .1 Provide an environmental seal around the outer jacket of the cable and electrically bond the fitting to the cable armour prior to potting the explosion-proof seal.
      - .2 Allow the possibility of disconnection without disturbing the environmental seal, the electrical bonding or the explosion-proof seal.
    - .6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily-removable armour stop.
    - .7 (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.
    - .8 Approved products:
      - .1 T&B Startech XP series or approved equal in accordance with B7.

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 Do not splice cables. A continuous length is required for all feeds.



- .2 Install in accordance with manufacturer's recommendations, observing requirements for minimum bending radius and pulling tensions.

### **3.2 INSTALLATION OF BUILDING WIRES**

- .1 Install in conduit as per Section 26 05 34.

### **3.3 INSTALLATION OF TECK CABLE 0 -1000 V**

- .1 Where surface mounted, provide clamps spaced a maximum of 1 m apart, unless otherwise indicated.
- .2 Perform an insulation-resistance test on each conductor, prior to termination, utilizing a megohmmeter with a voltage output of 1000 volts DC. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one (1) minute. Investigate resistances less than fifty (50) megaohms, or deviations between parallel conductors. Conductors with insulation resistance values, at one (1) minute, less than twenty-five (25) megaohms, or that deviate from other similar conductors by more than 50% will be rejected.

### **3.4 TERMINATIONS AND SPLICES**

- .1 Wire nuts are permitted only in the following circuits:
  - .1 Lighting circuits.
  - .2 Receptacle circuits.
- .2 Exercise care in stripping insulation from wire. Do not nick conductors.
- .3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.
- .4 Where screw-type terminals are provided on equipment and instrumentation, terminate field wiring with insulated fork tongue terminals.
  - .1 Manufacturer: Thomas and Betts, Sta-Kon, or approved equal in accordance with B7.

### **3.5 INSTALLATION IN CONDUIT**

- .1 Utilize cable grips, appropriately selected to accommodate the type and geometry of the cable.
- .2 Utilize cable pulling lubricant, compatible with the cable and conduit.

### **3.6 CABLE IDENTIFICATION**

- .1 Install cable tags on all field cables at both ends of the cable.

### **3.7 TESTING**

- .1 Test all power conductors 10 AWG and larger in accordance with Section 26 08 05.

**END OF SECTION**

**Part 1            General**

**1.1                SUBMITTALS**

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

**Part 2            Products**

**2.1                MATERIALS**

- .1        Rod electrodes: copper clad steel, 19 mm diameter by 3 m long.
- .2        Conductors: bare, stranded, medium hard drawn copper wire.
  - .1        Size: as shown on the drawings or 2/0 AWG minimum for grounding electrode connections.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of local authority having jurisdiction.
- .2        Install connectors and cadweld in accordance with manufacturer's instructions.
- .3        Protect exposed grounding conductors during and after construction.

**3.2                ELECTRODE INSTALLATION**

- .1        Install ground rod electrodes.
  - .1        Location of rods are as per the drawings.
  - .2        Top of rods to be at least 150mm below finished grade.
  - .3        Accurately measure and mark the location of the actual ground electrodes on the as-built drawings.
  - .4        Provide sufficient slack between ground rods and connections to the building to avoid breaking stresses.
  - .5        Minimum depth of burial of ground conductor: 450mm
- .2        Make required grounding connections.
  - .1        Utilize thermo-weld or Burndy compression connections to the ground rods.

- .2 Utilize thermo-weld connections or Burndy compression connections for underground wire to wire connections.
- .3 Where Burndy compression connections are used:
  - .1 Submit product data of compression tool, die, and compression connectors to the Contract Administrator for review.
  - .2 All compression connections shall have the die index number embossed into the compression connector after installation, demonstrating that the proper compression pressure has been obtained.
- .3 Install ground rod electrodes at location shown on the drawings.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE).
  - .1        ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2    Canadian Standards Association, (CSA International).

**Part 2            Products**

**2.1                EQUIPMENT**

- .1    Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2    Insulated grounding conductors: green, type RW90.
- .3    Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1        Grounding and bonding bushings.
  - .2        Protective type clamps.
  - .3        Bolted type conductor connectors.
  - .4        Thermit welded type conductor connectors.
  - .5        Bonding jumpers, straps.
  - .6        Pressure wire connectors.

**Part 3            Execution**

**3.1                INSTALLATION GENERAL**

- .1    Install connectors in accordance with manufacturer's instructions.
- .2    Protect exposed grounding conductors from mechanical injury.
- .3    Use mechanical connectors for grounding connections to equipment provided with lugs.
- .4    Use Burndy compression connectors, or approved equal in accordance with B7, for all grounding splices and terminations, unless otherwise indicated.
- .5    Soldered joints not permitted.

**3.2                EQUIPMENT GROUNDING AND BONDING**

- .1    Install grounding connections to transformers.

□

- .2 Install bonding connections to all electrical equipment.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform tests before energizing electrical system.

**END OF SECTION**

**Part 1            General**

**1.1                NONE**

.1                None.

**Part 2            Products**

**2.1                FRAMING AND SUPPORT SYSTEM**

.1                Materials:

.1                Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.

.2                Finishes:

.1                Wet locations: Aluminum.

.2                Indoors, dry locations: Aluminum.

.3                Nuts, bolts, machine screws: Stainless steel.

**2.2                CONCRETE AND MASONRY ANCHORS**

.1                Materials: hardened steel inserts, zinc plated for corrosion resistance.

.2                Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four (4).

.3                Manufacturer: Hilti (Canada) Limited or approved equal in accordance with B7.

**Part 3            Execution**

**3.1                INSTALLATION**

.1                Secure equipment to solid masonry, tile and plaster surfaces with galvanized anchors.

.2                Secure equipment to poured concrete with expandable inserts.

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

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

.5                Maximum spacing between conduit supports:

.1                As per Section 26 05 34.

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

- .1 One (1) hole aluminum straps to secure surface conduits and cables 50 mm in diameter and smaller.
- .2 Two (2) hole aluminum straps for conduits and cables larger than 50 mm in diameter.
- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2 Support two (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 For surface mounting of two (2) or more conduits use channels, with maximum centre spacing as indicated above.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Materials and components for splitters, junction, pull boxes, and cabinets.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International).
  - .1            CAN/CSA-C22.2 No.76, Splitters.

**1.3                SUBMITTALS**

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

**Part 2            Products**

**2.1                JUNCTION AND PULL BOXES**

- .1            Type and size as indicated on the drawings, or sized as per code requirements.
- .2            Utilize Stainless Steel (316) construction for NEMA 4X junction and pull boxes.

**Part 3            Execution**

**3.1                JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1            Install pull boxes in inconspicuous but accessible locations.
- .2            Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3            Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

**3.2                IDENTIFICATION**

- .1            Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2            Install Size 3 identification labels indicating system voltage and phase, or loop number for control wiring.
- .3            Install a permanent label or lamacoid on the cover of all junction boxes indicating the circuit(s) contained within.
  - .1            Example: F72-2 (Panel F72, circuit 2)

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**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
  - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 211.2, Rigid PVC (Un-plasticized) Conduit.
  - .5 CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.
- .2 Submittals
  - .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures for the following:
    - .1 Metal conduit fittings.
    - .2 Fittings for hazardous locations.

**Part 2 Products**

**2.1 GENERAL**

- .1 Flood Station Material Requirements:
  - .1 Main Floor (Motor Room): Rigid PVC, FT4
  - .2 Wet Well: Rigid Aluminum, threaded
  - .3 Dry Well: Rigid PVC, FT4

**2.2 RIGID PVC CONDUIT**

- .1 Meets CSA C22.2 No. 211.2.
- .2 Minimum conduit diameter size: 19 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

**2.3 FLEXIBLE METAL CONDUIT**

- .1 To CSA C22.2 No. 56, liquid-tight flexible metal.
- .2 Minimum conduit diameter size: 19 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

**2.4 CONDUIT FASTENINGS**

- .1 One (1) hole straps to secure surface conduits 50 mm in diameter and smaller.
- .2 Two (2) hole straps for conduits larger than 50 mm in diameter.

- .3 Strap material to match conduit material.
- .4 Beam clamps to secure conduits to exposed steel work.
- .5 Channel type supports for two (2) or more conduits or as shown in the Drawings.
- .6 Threaded rods, 6 mm diameter. to support suspended channels.

## **2.5 CONDUIT SPACERS**

- .1 PVC coated malleable iron spacers, CSA approved for the purpose.
- .2 Aluminum channel may be utilized where conduits are grouped, however a non-metallic spacer must be provided between the aluminum channel and concrete.

## **2.6 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified.
- .2 Coating: same as conduit.
- .3 All fittings to be liquid and dust tight.
- .4 Enclosure Connections:
  - .1 Connections in dry locations (bottom or side)
    - .1 Locknuts inside and outside enclosures.
    - .2 Insulated bushings Thomas & Betts Series 222 or approved equal in accordance with B7.
  - .2 Connections in wet locations and tops of enclosures in dry locations
    - .1 Liquid-tight threaded hubs
    - .2 Insulated bushings Thomas & Betts Series 222 or approved equal in accordance with B7.
  - .3 Utilize insulated grounding bushings at all non-metallic enclosure entries for metallic conduit, or as required for bonding in accordance with Code and good practice.
- .5 Elbows:
  - .1 Utilize factory elbows for 27mm diameter and larger conduits.
- .6 Threaded Hubs for Metal Conduit:
  - .1 Liquid and dust tight with insulated throat.
  - .2 Approved products:
    - .1 Thomas & Betts "Bullet Hub" 370AL Series or approved equal in accordance with B7.
- .7 Fittings for Metal Conduit:
  - .1 Cast metal.
  - .2 Gasketed covers.

- .3 Approved products:
  - .1 Crouse-Hinds Canada Ltd. "Condulet" series.
- .8 Explosion proof conduit sealing fittings:
  - .1 CSA Certified suitable for Hazardous Locations – Class I, Zone 1, Group IIA.
  - .2 Material: Cast aluminum.
- .9 Sealing Compound. As recommended by manufacturer.

## **2.7 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 ROUTING**

- .1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.
- .2 Route conduits on existing or new pipe rack or suspended channels where possible. Conduits routing shall be installed to run parallel or perpendicular to building lines. Do not route conduit in angular directions with respect to building lines.
- .3 Avoid routes that would interfere with any potential maintenance activities such as but not limited to:
  - .1 Roof Hatches.
  - .2 Floor Hatches.
  - .3 Mechanical Dampers.
  - .4 Building/Equipment Door Openings.
  - .5 Man Hole Covers.
- .4 Where not specifically shown in detail on the Drawings, review proposed conduit routing with Contract Administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

### **3.2 INSTALLATION - GENERAL**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .3 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .4 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.
- .5 Ensure electrical continuity in all metallic conduit systems.

- .6 All conduit shown exposed in finished areas is to be free of unnecessary labels and trademarks.
- .7 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant. Seal all conduits entering or leaving hazardous classified areas with approved seals.
- .8 Where conduits pass through walls, group and install through openings. After all conduits shown on the Drawings are installed, close wall openings with material compatible with the wall construction.
- .9 Install fish cord in empty conduits.
- .10 Dry conduits out before installing wire.
- .11 Install ground bonding wire in all conduits. Size ground wire as per CEC Table 17.
- .12 Underground Conduits:
  - .1 Slope conduits away from the building to provide drainage.
- .13 Surface Conduits:
  - .1 Run parallel or perpendicular to building lines. Do not run conduit in angular directions from building lines.
  - .2 Group conduits wherever possible on suspended or surface channels.
  - .3 Provide a minimum spacing of 100% of the largest conduit diameter between adjacent conduits.
  - .4 Do not pass conduits through structural members, except as indicated.
  - .5 Do not locate conduits less than 152 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.
  - .6 Install spacers as required to provide spacing between the conduits and the supporting surface, with a minimum spacing as follows:
    - .1 Above grade spaces not classified as CEC Category 1 or 2:
      - .1 Drywall / Wood surfaces: no space required.
      - .2 Masonry / concrete surfaces: 6 mm.
    - .2 Below grade spaces: 12 mm.
- .14 Colour Coding:
  - .1 Apply plastic tape or paint colour coded bands to conduits at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.
  - .2 Bands: 38 mm wide prime colour and 19 mm wide auxiliary colours
  - .3 Band colours as per the following table.

System	Prime Band	Aux. Band
Medium Voltage (> 750 V)	Orange	
347 / 600 V	Yellow	

120 / 208 / 240 V Power	Black	
UPS 120 / 208 / 240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (< 50 V)	Blue	Orange
Intrinsically Safe	Blue	White

### 3.3 PVC CONDUIT

- .1 Concrete Penetrations:
  - .1 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.
- .2 Maximum spacing between supports for rigid PVC conduit:
  - .1 27mm diameter conduit: 0.75 m
  - .2 35mm diameter conduit: 0.75 m
  - .3 41mm diameter conduit: 1.2 m
  - .4 53mm diameter conduit: 1.5 m
  - .5 63mm diameter conduit: 1.5 m
  - .6 78mm diameter conduit: 1.5 m
  - .7 91mm diameter conduit and larger: 2.0 m

### 3.4 METAL CONDUIT

- .1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .2 Mechanically bend conduits over 19 mm in diameter.
- .3 Concrete Penetrations:
  - .1 Sleeves for Aluminum Conduit.
  - .2 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.
  - .3 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.
  - .4 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 50 mm above finished floor level or housekeeping pad level.
- .4 Maximum spacing between supports for rigid metallic conduit:
  - .1 16mm diameter conduit: 1.0 m
  - .2 21mm diameter conduit: 1.5 m
  - .3 27mm diameter conduit: 1.5 m
  - .4 35mm diameter conduit: 2.0 m

.5 41mm diameter conduit and larger 2.5 m

### **3.5 LIQUID-TIGHT FLEXIBLE CONDUIT**

- .1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.
- .2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four (4) times the conduit diameter.
- .3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

### **3.6 INSTALLATIONS IN CATEGORY 1 LOCATIONS**

- .1 Arrange to provide drainage at frequent intervals to suitable locations.
- .2 Equip with approved fittings to permit the moisture to drain out of the system.
- .3 Install the conduit with a minimum of 12 mm space from the supporting surface.
- .4 Install every joint to be water-tight.
- .5 Where conduit leaves a warm room and enters a cooler atmosphere, seal the conduit and arrange the conduit in a manner to avoid condensation accumulation at the seal.

### **3.7 INSTALLATIONS IN CATEGORY 2 LOCATIONS**

- .1 Comply with all requirements of Category 1 locations.

### **3.8 INSTALLATIONS IN CATEGORY 2 WET LOCATIONS**

- .1 Comply with all requirements of Category 1 locations.

### **3.9 INSTALLATIONS IN HAZARDOUS ZONE 1 LOCATIONS**

- .1 Explosion-proof conduit sealing fittings:
  - .1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.
  - .2 Add sealing compound following manufacturer's instructions.

### **3.10 INSTALLATIONS IN HAZARDOUS ZONE 2 LOCATIONS**

- .1 Explosion-proof conduit sealing fittings:
  - .1 Install sealing fittings as indicated and on all new conduit installations to meet CEC requirements.
  - .2 Add sealing compound following manufacturer's instructions.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1            Canadian Standards Association, (CSA International)
- .2            Insulated Cable Engineers Association, Inc. (ICEA)

**Part 2            Products**

**2.1                CABLE PROTECTION**

- .1            38 x 190 mm planks pressure treated, water repellent preservative.

**Part 3            Execution**

**3.1                DIRECT BURIAL OF CABLES**

- .1            After sand bed specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2            Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3            Underground cable splices not acceptable.
- .4            Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .5            Cable separation:
  - .1            100% minimum, or greater as shown on drawings.
- .6            After sand protective cover specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, install continuous row of 38 x 190 mm pressure treated planks as indicated to cover length of run.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        NETA Acceptance Testing Specifications, 2003 (ATS-2003)

**1.2                TESTING REPORT**

- .1        Prepare an overall inspection and test report that details all investigations and tests.
- .2        The Contractor shall furnish paper copies in the hard-copy O&M Manuals and electronic copies on CD for the electronic (soft-copy) O&M Manual.
  - .1        The electronic copies of the report, including the test forms, shall be provided in PDF format.
  - .2        The Microsoft Word version of the all completed test forms provided to the Contractor shall also be included on the CDs.
- .3        The report shall be neat and organized. Any omissions, inconsistencies, or incomplete work identified by the Contract Administrator shall be corrected and incorporated into the report in the appropriate section, and completely resubmitted.
- .4        A draft of each report shall be completed and sent to the Contract Administrator for review a maximum of one month after the completion of the inspections at the Site.
- .5        The final report shall be submitted a maximum of two weeks after the Contractor receives the mark-up of the draft report from the Contract Administrator.
- .6        The report shall include the following:
  - .1        Summary of project.
  - .2        Testing Equipment.
  - .3        Detail the type, manufacturer, model, and last calibration date of all testing equipment.
  - .4        Description of equipment tested.
  - .5        Description of all tests.
  - .6        Typed inspection forms including:
    - .1        Identification of the testing organization.
    - .2        Equipment identification.
    - .3        Humidity, temperature, and other conditions that may affect the results of the tests/calibrations.
    - .4        Date of inspections, tests, maintenance, and/or calibrations.
    - .5        Identification of the testing technician.
    - .6        Indication of inspections, tests, maintenance, and/or calibrations performed and recorded, along with charts, and graphs as applicable. All measurements and readings taken shall be noted for inclusion in the report. Where repairs are made, measurements and readings before and after the repair shall be included.

- .7 Indication of expected results, when calibrations are to be performed.
- .8 Indication of “as-found” and “as-left” results, as applicable.
- .7 Itemized list of all repaired deficiencies which shall include:
  - .1 Detailed description of the deficiency.
  - .2 The cost associated with the deficiency repair.
- .8 Itemized list of all un-repaired deficiencies encountered which shall include:
  - .1 Detailed description of the deficiency.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used

**Part 3 Execution**

**3.1 SCOPE OF TESTING**

- .1 All medium voltage cables,
- .2 All low voltage cables 1/0 AWG or larger,
- .3 Grounding system,
- .4 5kV Fusible Disconnect,
- .5 Check phase rotation to ensure that all existing motors within the facility will be rotating correctly prior to putting the systems into service.
- .6 Check, confirm and document cable termination torque settings.

**3.2 INSPECTION, TESTING AND MAINTENANCE PROCEDURES**

- .1 General
  - .1 All tests are based on NETA (InterNational Electrical Testing Association) standard ATS-2003. Where manufacturer’s specifications, tolerances, and/or published data are not available, refer to the appropriate tables in ATS-2003.
  - .2 Torque all accessible bolted electrical connections. Additional requirements apply as specified.
  - .3 Utilize the existing drawings for reference while performing the specified electrical inspection work. Where the existing installation deviates from that shown on the drawings, mark-up the drawings with red pen as required to reflect the installation. Include the marked-up drawings in the report.
  - .4 The scope of required drawing checks is limited to the equipment and components that are part of the electrical inspection work.
  - .5 Any repairs made that affect the accuracy of the drawings shall be marked up on the drawings.

- .6 Drafting of drawings is not required.
  - .7 All inspection values, readings, corrections, and assessments shall be clearly recorded for inclusion within the report.
  - .8 Where corrections or repairs are made, record both as found/as left test readings on the inspection sheet. If space is not provided on the inspection form, record the readings in the Note fields or on a separate sheet.
- .2 Inspection Forms
- .1 The inspection forms to be completed by the Contractor are provided for reference in PDF format.
  - .2 Microsoft Word form templates will be provided prior to the work being initiated.
  - .3 Make appropriate print-outs of the inspection forms and utilize for entry of data and test results on site.
  - .4 Utilizing the Microsoft Word form templates, enter the data recorded manually into the forms electronically.
  - .5 Complete the inspection forms in the entirety and include them in the report.
  - .6 Submit electronic PDF copies of the inspection forms.
  - .7 The scope of work required in the specifications is in no way limited by the inspection forms, or spaces provided. Provide additional pages, documents, and forms as required to provide a complete report.
  - .8 The inspection forms may be updated during the Work by the City or Contract Administrator. Utilize the latest forms provided.

### **3.3 WIRES AND CABLES, GREATER THAN 1000 V**

- .1 Inspection and testing shall consist of the following:
  - .1 For cables/wires 4/0 AWG or larger, inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate and correct values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - .2 Torque all accessible bolted electrical connections.
  - .3 Inspect compression applied connectors for correct cable match and indentation.
  - .4 Inspect grounding and cable/conduit support.
  - .5 Verify that visible cable bends meet or exceed the minimum allowable bending radius.
  - .6 Measure length of cable/conduit and record in meters.
  - .7 If cables/wires are terminated through window-type current transformers, inspect to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.
  - .8 Perform an insulation-resistance test on each conductor. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 1000 megaohms. The voltage applied shall be 500 Vdc for 300 V rated cables, and 1000 Vdc for 600 V or 1000 V rated cables.

**3.4 GROUNDING SYSTEM**

- .1 Inspection and testing shall consist of the following:
  - .1 Perform resistance tests between the main grounding electrode and grounded points in the electrical distribution system. Investigate connections with a resistance greater than 0.5 milliohms.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Service equipment and installation.

**1.2                RELATED SECTIONS**

- .1        Section 01 74 11 - Cleaning
- .2        Section 26 05 27 - Grounding - Primary.
- .3        Section 26 05 28 - Grounding - Secondary.
- .4        Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

**1.3                SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .3        Submit shop drawings and indicate:
  - .1        Outline dimensions.
  - .2        Configuration of identified compartments.
  - .3        Anchoring method and dimensioned foundation template.
  - .4        Cable entry and exit locations.
  - .5        Dimensioned position and size of busbars and details of provision for future extension.
  - .6        Schematic and wiring diagrams.
  - .7        Enclosure finish.
- .4        Closeout Submittals: provide as-built drawings and supplemental information for motor control centre as specified in Section 01 78 00 - Closeout Submittals.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials where possible.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal packaging material for recycling.
- .4        Divert unused metal and wiring materials from landfill to metal recycling facility.
- .5        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 5 kV SWITCHGEAR c/w FUSIBLE DISCONNECT SWITCH COMPARTMENT & UTILITY METERING COMPARTMENT (SGR-F70)**

- .1 Requirements:
  - .1 Rating: 5 kV (or higher), 200A (or higher), 3ph, 4 wire. Refer to Drawings
  - .2 Service entrance rated.
  - .3 Load break / load make rated to meet CSA C22.1-2015 Rule 36-204(1)(b).
  - .4 Interrupting Rating: 25 kA minimum.
  - .5 Fuses: Type and ampere rating as shown on the drawings.
    - .1 Provide three (3) spare fuses in addition to the fuses within the operating equipment of each type and rating:
      - .1 3x spare 40E fuses,
      - .2 3x spare 80E fuses,
      - .3 3x spare 125E fuses.
  - .6 Manually operated switch.
  - .7 Integrated 5kV utility metering compartment.
    - .1 Metering components (meter, CTs, and PTs) supplied by Manitoba Hydro.
    - .2 Meter socket supplied with switchgear or separately by the installation Contractor.
  - .8 Dead front construction.
  - .9 Outer and inner door on main switch compartment. Outer door will be locked by City. Inner door will be locked by electric utility. Outer door to cover disconnect switch handle.
  - .10 All compartments and sections to be barriered from adjoining sections.
  - .11 Copper bus.
  - .12 Cabling: 5/8 kV rated, EPR or EPDM, copper conductors, with 133% insulation when applied to a 5 kV system.
  - .13 Switch Kirk-Key Interlock: Interlocked with downstream supply transformer high voltage (HV) compartment door. Removal of the key from 5kV switchgear only allowed when 5kV switch is in the OFF position. Removal of the key from switchgear and insertion into HV compartment door of transformer will allow opening of transformer HV compartment door. Switching ON of switchgear 5kV switch only permitted with key inserted into switchgear kirk key slot.
  - .14 Enclosure Rating: NEMA Type 3R.
  - .15 Enclosure Size:
    - .1 Two (2) sections wide.
    - .2 Each section shall not exceed 36" width x 48" depth x 96" height.
  - .16 Ensure switchgear adheres to all Manitoba Hydro's metering requirements as indicated in the latest edition of the Customer Metering Standards.
- .2 Factory inspected and certified

- .1 Submit a factory certificate indicating that the equipment has been inspected, tested, verified, and is fit for service prior to shipping to site. The certificate shall be signed and dated by the Quality Assurance factory representative. Submit the certificate to the Contract Administrator prior to shipping.
- .3 Manufacturer:
  - .1 Strong Electric.
  - .2 JRS MFG
  - .3 S&C Electric,
  - .4 ABB,
  - .5 Or approved equal in accordance with B7.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install conduit sleeves, conduits, cable sleeves, ground cabling, and transformer pad.
- .2 Install service equipment.
- .3 Connect to incoming service.
- .4 Connect to outgoing load circuits.
- .5 Make primary grounding connections in accordance with Section 26 05 27 - Grounding - Primary.
- .6 Make secondary grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.
- .7 Make provision for power supply authority's metering.
- .8 Provide spare components as indicated in the specifications and drawings.

**END OF SECTION**



**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes:
  - .1        Materials, applications, installation and verification for excavating, trenching and backfilling.

**1.2                REFERENCES**

- .1    City of Winnipeg (CW).
  - .1        CW3110 – Sub-Grade, Sub-Base, and Base Course Construction.
  - .2        CW3170 – Earthwork and Grading
  - .3        CW3230 – Full-Depth Patching of Existing Slabs and Joints.
- .2    American Society for Testing and Materials International (ASTM).
  - .1        ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2        ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3        ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
  - .4        ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
  - .5        ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
  - .6        ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .3    Canadian General Standards Board (CGSB).
  - .1        CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2        CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .4    Canadian Standards Association (CSA International).
  - .1        CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1            CSA-A3001, Cementitious Materials for Use in Concrete.
  - .2        CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

**1.3                DEFINITIONS**

- .1    Rock: any solid material in excess of 1 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.

- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .3 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .4 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.
- .5 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136:
    - .2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Sub-grade – the natural in-situ material.
- .9 Sub-base – where required, the layer of material provided between the sub-grade and the base course.
- .10 Base course – the layer of material immediately underlying the pavement

#### **1.4 SUBMITTALS**

- .1 Upon request, submit material test results to the Contract Administrator a minimum of two weeks before excavation begins.

#### **Part 2 Products**

##### **2.1 MATERIALS**

- .1 Sub-Base Materials
  - .1 Sub-base material of the type(s) as shown on the Drawings or indicated in the Specifications.

- .2 Suitable site sub-base material will be of a type approved by the Contract Administrator.
- .3 Clay borrow sub-base material will be of a type approved by the Contract Administrator.
- .4 Crushed sub-base material will be crushed aggregate, crushed limestone or crushed concrete pavement.
- .5 Crushed sub-base material will be well-graded and conform to the following grading requirements:

Canadian Metric Sieve Size	Percent of Total Dry Weight Passing each Sieve		
	<u>50 mm max.</u>	<u>100 mm max.</u>	<u>150mm max.</u>
150 000			90-100%*
100 000	3197-100%	75-90%	
50 000	100%		
25 000		30-50%	50% max.
5 000	25-80%		
80	5-18%	5% max.	

\* The maximum allowable size is 300mm.

- .6 150 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading 1 of ASTM C535, Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 50 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading A of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .8 Crushed concrete sub-base material will be a mixture of reclaimed Portland Cement concrete and asphaltic concrete. The contents of the material will be limited to the following percentages based on weight.
  - .1 minimum of 85% recycled Portland Cement concrete
  - .2 maximum of 15% recycled asphaltic concrete
  - .3 maximum of 3% clay
  - .4 maximum of 1% foreign material

.2 Base Course Materials

- .1 Base course material will be approved by the Contract Administrator.
- .2 Base course material will consist of sound, hard, crushed rock or crushed gravel and will be free from organic or soft material that would disintegrate through decay or weathering.

- .3 The base course material will be well graded and conform to the following grading requirements:

Canadian Metric <u>Sieve Size</u>	Percent of Total Dry Weight Passing each Sieve	
	<u>Granular</u>	<u>Crushed Limestone</u>
25 000	100%	
20 000	80-100%	100%
5 000	40-70%	40-70%
2 500	25-50%	25-60%
315	13-30%	8-25%
80	5-15%	6-17%

- .4 Base course material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with grading B of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .5 The material passing the 315 sieve will have a liquid limit not greater than 25 and a plasticity index not greater than 6.
- .6 Where base course is being placed under an asphaltic concrete pavement, the aggregate retained on a No. 5 000 sieve will contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate will be considered as that aggregate having at least one fractured face.

.3 Asphalt Cuttings for Base Course Material

- .1 Asphalt cuttings produced from planing of asphalt pavements or overlays in accordance with CW 3450 may be used as a base course material where indicated in the Specifications or as approved by the Contract Administrator.
- .2 Asphalt cuttings will be well graded and have a maximum particle size of 40 mm.

.4 Lime or Portland Cement

- .1 Use either Lime or Type 10 normal Portland Cement for drying the sub-grade.
- .2 Supply Lime in accordance with CSA A82.43.
- .3 Supply Portland Cement in accordance with CSA A5.

.5 Imported Fill Material

- .1 Imported fill material will consist of low to medium plastic clays or mixtures of sand and clay, uniform in texture.
- .2 The fill material shall be free of wood, vegetation, concrete rubble or stones larger than 25 mm in diameter.

**Part 3 Execution**

**3.1 SITE PREPARATION**

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

**3.2 PAVEMENT REMOVAL**

- .1 Remove existing concrete pavement, including curbs and asphalt overlays at locations as shown on the Drawings or as directed by the Contract Administrator. Remove all pavements to a combined thickness of 300 millimetres, unless otherwise indicated in the Specifications.
- .2 Remove existing asphalt pavement including asphalt curbs at locations as shown on the Drawings or as directed by the Contract Administrator. Remove pavement to a maximum thickness of 150 millimetres, unless otherwise indicated in the Specifications.
- .3 Saw-cut the existing pavement full-depth along the limits designated for removal.
- .4 Utilize backhoe type equipment unless approved otherwise by the Contract Administrator.
- .5 Dispose of material as per the following:
  - .1 Haul and dispose of waste material excavated from the Site including surplus, suitable, unsuitable and other material removed in accordance with the Specifications to a disposal location approved by the Contract Administrator.
  - .2 The City reserves the right to direct material to be hauled to a local site indicated in the Specifications.
  - .3 Clean up material dropped or spilled during hauling operations as directed by the Contract Administrator.

**3.3 EXCAVATION**

- .1 Excavate in-situ material to the depth to accommodate the pavement structure as shown on the Drawings or as directed by the Contract Administrator.
- .2 Stockpile suitable in-situ material and suitable site sub-base material at locations on site as directed by the Contract Administrator.
- .3 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .4 Dispose of surplus suitable site material and unsuitable material such as frost heaving clays, silts, rocks and rubble as per Section 3.2.5.
- .5 Strip and stockpile topsoil from the site in a manner which will prevent contamination of topsoil with underlying soil materials. Stockpile the stripped topsoil at locations on site for later use.

- .6 The limits of excavation will be taken as a vertical plane 450 mm beyond the limits of the proposed pavement except when slip form paving equipment is specified for placement of the concrete pavement, the limits of excavation will be increased to a vertical plane 750 mm beyond the limits of the proposed pavement.
- .7 During excavation, the Contractor will be advised by the Contract Administrator as to which areas have an unsuitable sub-grade. Extend the excavation either to the lower limit of the unsuitable material or to a depth as directed by the Contract Administrator.
- .8 Remove wooden poles, concrete bases, or tree stumps encountered under pavements to the top of subgrade or 1 m below the bottom of the pavement surface, whichever depth is greater.
- .9 Backfill and compact over-excavated areas with sub-base material approved by the Contract Administrator.
- .10 Excavate additional material beyond the boulevard grading and ditch grading limits as directed by the Contract Administrator.

### **3.4 PREPARATION OF SUB-GRADE AND PLACEMENT OF SUB-BASE**

- .1 Compact the sub-grade after the bottom of the excavation has been approved by the Contract Administrator.
- .2 Compact areas of suitable sub-grade material, the full width of the excavation, to a minimum of 95% Standard Proctor Density.
- .3 Place and compact suitable site sub-base material before placing any new sub-base material, as directed by the Contract Administrator.
- .4 Place and compact crushed sub-base material with or without geogrid as directed by the Contract Administrator in accordance with CW 3135.
- .5 Place and compact sub-base materials in layers to a depth of 3 times the maximum aggregate size or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Density, for the full width of the excavation, and each layer must be leveled and approved by the Contract Administrator before the succeeding layer may be placed.
- .6 Layering, mixing or blending of crushed concrete with crushed aggregate or crushed limestone sub-base materials is not allowed.
- .7 Recompact or replace any layer, which has been rejected as directed by the Contract Administrator.
- .8 When excess water has been applied, either by sprinkling operations or by precipitation, to cause local or continuous pondage, soil compaction will not be permitted until sufficient soil drying has occurred, creating a condition lending itself favourably to compacting operations. Exercise necessary precautions to protect compacted areas against excess wetting from any natural or artificial sources of water application.

- .9 Should excess moisture from continuous or heavy precipitation threaten to unduly delay the completion of the Contract. Apply in writing to the Contract Administrator requesting permission to use Lime or Portland Cement to dry out the clay sub-grade or sub-base material at specific location(s).

### **3.5 PLACEMENT OF SUB-BASE WITH GEOTEXTILE FABRIC**

- .1 Install separation or separation/reinforcement geotextile fabric in accordance with CW 3130.
- .2 For stable sub-grades, place and compact sub-base material to a minimum depth of 150 mm.
- .3 For unstable sub-grades, place and compact sub-base material to a minimum depth for 300 mm or greater thickness as directed by the Contract Administrator.
- .4 Place sub-base material by end-dumping methods and level with front-end loader type of equipment as approved by the Contract Administrator to avoid damage to the geotextile fabric and minimize sub-grade failures.
- .5 Layering, mixing or blending of crushed concrete with crushed aggregate or crushed limestone sub-base materials is not allowed.
- .6 Avoid sudden stops or sharp turns by construction equipment during placement of sub-base materials.
- .7 Construction traffic will not be allowed to travel on the placed sub-base material until approved by the Contract Administrator.

### **3.6 PLACEMENT OF BASE COURSE MATERIAL**

- .1 Place and compact base course material to a minimum 75 mm thickness for pavement and approaches to a minimum of 100% Standard Proctor Density for the full width of the excavation unless otherwise shown on the Drawings or as directed by the Contract Administrator.
- .2 Level the compacted base course to the finished base course elevation.
- .3 Maintain the finished base course until the pavement is placed.
- .4 Place and compact base course material as a levelling course to a maximum thickness of 50 mm for sidewalks and miscellaneous concrete slabs, to 90% Standard Proctor Density.
- .5 Place and compact base course material immediately beneath pavement forms to provide firm support.

### **3.7 PLACEMENT OF IMPORTED FILL**

- .1 Place fill materials to satisfy the grading requirements of boulevard and ditches.
- .2 Supply material in accordance with Section 2.5 of this specification.

- .3 Compact to a minimum of 90% Standard Proctor Density.

### **3.8 GRADING**

- .1 Grading of areas to receive sod will be understood to mean the required excavation or backfilling to a depth up to 150 mm so that the areas medians, after compaction, are at a uniform depth of 100 mm below finished grade shown on the Drawings.
- .2 Grade the areas to receive sod, unless otherwise shown on the Drawings or as directed by the Contractor Administrator.
- .3 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.
- .4 Excavate to a depth of up to 150 mm to meet the final grade 100 mm below finished boulevard grade.
- .5 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 150 mm to meet the final grade 100 mm below finished boulevard grade.
- .6 Supply backfill material in accordance with Section 2.1 of this specification.
- .7 Compact backfill materials to a minimum of 90% Standard Proctor Density.

### **3.9 QUALITY OF SUB-GRADE, SUB-BASE, AND BASE COURSE LAYERS**

- .1 Determine the Standard Proctor Density for the sub-grade, sub-base and base course materials at the optimum moisture content in accordance with ASTM Standard D698. The field density of each sub-grade, sub-base and base course layers will be a percentage of the applicable Standard Proctor Density, in accordance with in Sections 3.3, 3.4 and 3.5 of this specification.
- .2 Utilize quality control tests to determine the acceptability of the sub-grade, sub-base and base course layers, as placed and compacted before the succeeding layer may be applied.
- .3 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- .4 The frequency and number of tests will be as directed by the Contract Administrator.
- .5 Fill promptly, holes made by the removal of samples from the layers with appropriate material and thoroughly compact so as to conform in every way with the adjoining material.

### **3.10 DEWATERING AND HEAVE PREVENTION**

- .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 portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

### **3.11 BACKFILLING**

- .1 Vibratory compaction equipment is required.
- .2 Do not proceed with backfilling operations until completion of following:
  - .1 The Contract Administrator approved installations construction below finished grade.
  - .2 Inspection, testing, approval, and recording location of underground utilities.
  - .3 Removal of concrete formwork.
  - .4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness. Compact each layer before placing succeeding layer.
- .6 Backfilling around installations.
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 150 mm.
- .7 Install drainage system in backfill as directed by The Contract Administrator.

### **3.12 RESTORATION**

- .1 Prior to construction, inspect the grassed, pavement and gravel surfaces within and adjacent to the Site with the Contract Administrator to record the current condition. After construction and site cleanup is complete, re-inspect the condition with the Contract Administrator.
- .2 Restoration of grassed areas removed or damaged as result of construction activities will be restored in accordance with CW 3510. Restoration of grassed areas will not be measured for payment and shall be included as part of the Work being done.
- .3 Pavement damaged or removed as a result of construction activities will be restored in accordance with CW3230 and CW 3410. Restoration of the pavement will not be measured for payment and shall be included as part of the Work being done.

**END OF SECTION**