

## Part 1 General

### 1.1 SECTION INCLUDES

- .1 Administrative and procedural requirements for unit prices further to requirements specified in Parts C and D.
  - .1 Measurement and payment criteria applicable to Work performed under a unit price payment method.

### 1.2 UNIT PRICES

- .1 Description:
  - .1 Unit prices are an amount incorporated in the Contract for a specific product or portion of Work with a specified product on a per unit basis.
- .2 Requirements:
  - .1 Unit prices include:
    - .1 Labour and material.
    - .2 Cost for delivery.
    - .3 Handling.
    - .4 Temporary storage.
    - .5 Demolition, surface preparation, and installation.
    - .6 Fees for overhead and profit.
    - .7 Insurance, bonds and applicable taxes.
  - .2 Unit prices exclude access requirements, the costs of which are to be included in the Total Bid Price.
  - .3 Refer to individual Sections for construction activities requiring unit prices.
- .3 Measurement and Payment Procedures:
  - .1 Unit prices are included in the Total Bid Price incorporating the estimated quantities provided.
    - .1 Unit prices are part of the Total Bid Price contract amount.
  - .2 Actual quantities will be identified by the Consultant in the presence of and with the assistance of the Contractor. The quantity will be measured and agreed upon by the Contractor and Consultant prior to commencement of Work.
  - .3 If the quantity is increased over that originally measured without consultation with the Consultant, the Contractor will not be paid for the increased quantity.
  - .4 Increases in quantities of unit prices included in the Agreement will be changed by a Change Order based on the unit prices included in the Agreement.
  - .5 Decreases in quantities of unit prices included in the Agreement will be changed by a Change Order based on the unit prices included in the Agreement.
- .4 Schedule of Unit Prices:
  - .1 Supplemental Reinforcing:
    - .1 Related section:
      - .1 Section 03 20 00 – Concrete Reinforcing
    - .2 Unit prices:
      - .1 Form B - Prices: Item - Supplemental Reinforcing
    - .3 Measurement procedures:

- .1 Measure reinforcing steel in kilograms of steel incorporated into Work, computed from theoretical unit mass specified in CSA G30.18 for lengths and sizes of bars as indicated or authorized in writing by the Contract Administrator.
- .2 Unit of measure: Per kilogram (kg).
- .3 Minimum unit of payment: 0.5 kg.
- .2 Supplemental Dowels
  - .1 Related section:
    - .1 Section 03 20 00 – Concrete Reinforcing
  - .2 Unit prices:
    - .1 Form B - Prices: Item - Supplemental 10M Dowels
    - .2 Form B - Prices: Item - Supplemental 15M Dowels
  - .3 Measurement procedures:
    - .1 Dowels will be measured individually and will include dowel drilling, cleaning, preparation, epoxy supply and placement, and bar insertion, but excluding steel costs which will be covered by the supplemental reinforcing Unit Price per kilogram.
    - .2 The Contract Administrator and the Contractor will count and agree upon the numbers and lengths of bars as well as the number of bar embedment. These agreed upon number will form the basis for payment.
    - .3 Unit if measure: Per dowel.
    - .4 Minimum unit of payment: one dowel
- .3 Top Surface Concrete Repairs
  - .1 Related sections:
    - .1 Section 03 91 10 – Surface Preparation of Concrete Delamination Repair.
    - .2 Section 03 92 12 – Top Surface Concrete Repairs with Rapid Setting Mortar.
  - .2 Unit prices:
    - .1 Form B - Prices: Item - Top Surface Concrete Repairs 0-75mm depth
    - .2 Form B - Prices: Item - Top Surface Concrete Repairs 75-150mm depth
  - .3 Measurement procedures:
    - .1 In accordance with this Section.
    - .2 Primary depth: Up to 75mm and at no point less than 40mm in depth.
    - .3 Secondary depth: Up to 150mm depth and at no point less than 75mm in depth.
    - .4 Unit of measure: m<sup>2</sup>.
    - .5 Minimum unit of payment: 0.1 m<sup>2</sup>
- .4 Form and Pour Repairs
  - .1 Related sections:
    - .1 Section 03 91 10 – Surface Preparation of Concrete Delamination Repair.

- .2 Section 03 93 30 - Form and Pour with Repair Mortar.
- .2 Unit prices:
  - .1 Form B - Prices: Item - Form and Pour Repairs 0-75mm depth
  - .2 Form B - Prices: Item - Form and Pour Concrete Repairs 75-150mm depth
- .3 Measurement procedures:
  - .1 In accordance with this Section.
  - .2 Primary depth: Up to 75mm and at no point less than 40mm in depth.
  - .3 Secondary depth: Up to 150mm depth and at no point less than 75mm in depth.
  - .4 Unit of measure: m<sup>2</sup>.
  - .5 Minimum unit of payment: 0.1 m<sup>2</sup>
- .5 Waterproofing Repairs
  - .1 Related sections:
    - .1 Section 07 55 56 – Hot Applied Rubberized Asphalt Waterproofing
  - .2 Unit prices:
    - .1 Form B - Prices: Item - Unit price for waterproofing repairs not shown on Drawings
  - .3 Measurement procedures:
    - .1 In accordance with this Section.
    - .2 Unit of measure: m<sup>2</sup>.
    - .3 Minimum unit of payment: 0.1 m<sup>2</sup>
- .6 Joint and Crack Routing and Sealing
  - .1 Related sections:
    - .1 Section 07 92 10 – Concrete Joint Sealants
  - .2 Unit prices:
    - .1 Form B - Prices: Item - Routing and sealing less than or equal to 12mm
    - .2 Form B - Prices: Item - Routing and sealing greater than 12mm
  - .3 Measurement procedures:
    - .1 In accordance with this Section.
    - .2 Unit of measure: lineal metre.
    - .3 Minimum unit of payment: 0.3m
- .7 Concrete Materials Testing:
  - .1 Related sections:
    - .1 Section 03 30 00 - Cast-in-Place Concrete
  - .2 Unit prices:
    - .1 Form B - Prices: Item - Unit Price for Concrete Testing
  - .3 Measurement procedures:
    - .1 In accordance with this Section.
    - .2 Unit of measure: per mortar cube
    - .3 Minimum unit of payment: one mortar cube

- .8 Direct Pull Out Tensile Testing:
  - .1 Related sections:
    - .1 Section 03 92 12 – Top Surface Concrete Repairs with Rapid Setting Mortar.
    - .2 Section 03 93 30 - Form and Pour with Repair Mortar
  - .2 Unit prices:
    - .1 Form B - Prices: Item - Unit Price for Direct Pull Out Tensile Test
  - .3 Measurement procedures:
    - .1 In accordance with this Section.
    - .2 Unit of measure: per test
    - .3 Minimum unit of payment: one test
- .9 Concrete Pedestals:
  - .1 Related sections:
    - .1 Section 03 20 00 - Concrete Reinforcing
    - .2 Section 03 30 00 - Cast-in-place Concrete
  - .2 Unit prices:
    - .1 Form B - Prices: Item - New traffic signals and street light concrete pedestals
  - .3 Measurement procedures:
    - .1 In accordance with this Section.
    - .2 Unit of measure: per location
    - .3 Minimum unit of payment: one location

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## Part 1 General

### 1.1 ADMINISTRATIVE

- .1 Submit specified submittals to *Consultant* for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the *Work*. Failure to submit in ample time is not considered sufficient reason for an extension of *Contract Time* or for *Product* substitutions or other deviations from the *Drawings* and *Specifications*.
- .2 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.
- .3 Do not proceed with *Work* affected by a submittal until review is complete.
- .4 Present *Shop Drawings*, *Product* data, and samples in SI metric units. Where items or information is not produced in SI Metric units, converted values are acceptable.
- .5 Present *Shop Drawings*, *Product* data, and samples in imperial units. Where items or information is not produced in imperial units, converted values are acceptable.
- .6 Review submittals, provide verified field measurements where applicable, and affix *Contractor's* review stamp prior to submission to *Consultant*. *Contractor's* review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the *Work* and *Contract Documents*.
- .7 Verify field measurements and that affected adjacent work is coordinated.
- .8 Submittals not meeting specified requirements will be returned with comments.
- .9 Reproduction of construction *Drawings* to serve as background for *Shop Drawings* is permitted. If construction *Drawings* are used for this purpose, remove references to *Consultant*.
- .10 Do not propose Substitutions or deviations from *Contract Documents* via *Shop Drawing*, *Product* data and sample submittals.

### 1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Indicate *Products*, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the *Work*.
- .2 Where *Products* attach or connect to other *Products*, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to *Drawings*, *Specifications* and other already reviewed *Shop Drawings*.
- .3 Accompany submittals with a transmittal information including:
  - .1 Date.
  - .2 *Project* title and number.
  - .3 *Contractor's* name and address.
  - .4 Identification of each submittal item and quantity.
  - .5 Other pertinent data.
- .4 *Shop Drawing* submittals shall include:
  - .1 Date and revision dates.
  - .2 *Project* title and number.
  - .3 Name and address of:
    - .1 Subcontractor.

- .2 Supplier.
- .3 Manufacturer.
- .4 *Contractor's* stamp, date, and signature of *Contractor's* authorized representative responsible for *Shop Drawing* review, indicating that each *Shop Drawing* has been reviewed for compliance with *Contract Documents* and, where applicable, that field measurements have been verified.
- .5 Details of appropriate portions of the *Work* as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationships to other parts of the *Work*.
- .6 Consultant's review stamp: Allow sufficient space on each sheet of shop drawings for Consultant's comments and review stamp without requiring the stamp to overwrite text of the Shop Drawing.
- .5 *Product* data submittals shall include material safety data sheets (MSDS) for all controlled *Products*.
- .6 Submit *Shop Drawings* where specified in the technical *Specifications* in electronic copy in PDF format.
- .7 Submit *Product* data sheets or brochures where specified in the technical *Specifications* in electronic copy in PDF format.
- .8 Where a submittal includes information not applicable to the *Work*, clearly identify applicable information and strike out non-applicable information.
- .9 Supplement standard information to include details applicable to *Project*.
- .10 Allow ten *Working Days* for *Consultant's* review of each submittal.
- .11 If upon *Consultant's* review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of *Work* may proceed.
- .12 If upon *Consultant's* review significant errors or omissions are discovered, as so noted, copy will be returned for correction and resubmission. Do not commence fabrication or installation.
- .13 *Consultant's* notations on submittals are intended to ensure compliance with *Contract Documents* and are not intended to constitute a change in the *Work* requiring change to the *Contract Price* or *Contract Time*. If *Contractor* considers any *Consultant's* notation to be a change in the *Work*, promptly notify *Consultant* in writing before proceeding with the *Work*.
- .14 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the *Work* proceeds. When resubmitting, notify *Consultant* in writing of any revisions other than those requested by *Consultant*.

### 1.3 SUBMISSIONS TO CONSULTANT:

- .1 Electronic versions via e-mail to:
  - .1 Consultant project manager at e-mail address identified at Construction Start-up Conference.
  - .2 Contract Administrator: [dwiebe@dillon.ca](mailto:dwiebe@dillon.ca).
- .2 Electronic versions via Consultant SharePoint site:
  - .1 Submit request to upload electronic submittals via Consultant's SharePoint site via e-mail to:
    - .1 Consultant project manager at e-mail address identified at Construction Start-up Conference.
    - .2 Contract Administrator: [dwiebe@dillon.ca](mailto:dwiebe@dillon.ca).
  - .2 Consultant will provide an e-mail invitation and link to upload files to SharePoint site.
- .3 Samples and hard copy versions to:
  - .1 Consultant project manager identified at Construction Start-up Conference at Consultant address identified in the General Conditions Article A-6 Receipt of and Addresses for Notices in Writing.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used

**END OF SECTION**

## Part 1 General

### 1.1 SECTION INCLUDES

- .1 This Section describes administrative and procedural requirements for:
  - .1 Proactive Contractor Activities to assure the quality of construction before and during execution of the Work.
  - .2 Reactive activities to verify that work completed conforms to the Contract Documents.
- .2 Having inspection and testing agencies by Contractor or Owner does not relieve the Contractor of their responsibility to perform Work in accordance with Contract Documents.

### 1.2 REFERENCE STANDARDS

- .1 "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in *Contract Documents*.
- .2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However, if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.
- .3 Reference standards establish minimum requirements. If *Contract Documents* call for requirements that differ from a referenced standard, the more stringent requirements shall govern.
- .4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to *Consultant* for clarification.

### 1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit schedule of testing and inspection activities to Consultant, Owner, applicable subcontractors, testing agencies, and other affected parties including the following:
  - .1 List each testing and inspection agency.
  - .2 Identify types of tests and inspections for each agency, and cross reference to applicable specification Section number-title in Contract Documents.
  - .3 Description of test and inspection.
  - .4 Identify applicable reference standard.
  - .5 Identify test and inspection method.
  - .6 Indicate number of each test and inspection required.
- .3 Reports: Submit reports in electronic PDF format prepared by inspecting and testing agencies for inspection and testing required by *Contract Documents* or by regulatory requirements, and performed by *Contractor* retained inspection and testing agencies to *Consultant* and *Owner*.
  - .1 Submit within five Working Days after completion of inspection and testing.
  - .2 Provide copies to:
    - .1 Subcontractor of work being inspected or tested.
    - .2 Manufacturer or fabricator of material being inspected or tested.



- .3 Provide copies of concrete test results to Concrete Supplier.
- .4 Tests and Mix Designs: Submit tests and mix designs requested, specified.
- .5 Mill Tests:
  - .1 Submit mill test certificates as requested.
  - .2 Submit mill test certificates as required in Contract Documents.
- .6 Certificates:
  - .1 Submit Product certificates as requested.
  - .2 Submit Product certificates as required in Contract Documents.
- .7 Qualification Statements: Upon request of the Consultant, submit qualification statements for Contractor, Subcontractors, and Manufacturers as follows:
  - .1 Submit in electronic PDF format on Contractor Letterhead and signed by a principal in the organization.
  - .2 Submit company description verifying compliance with qualifications specified in the Contract Documents.
  - .3 Submit resumes for:
    - .1 Project Manager.
    - .2 Site Supervisor.

#### 1.4 INDEPENDENT INSPECTION AND TESTING AGENCIES

- .1 Except as otherwise specified, *Owner* will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the *Work*.
- .2 Retain and pay for inspection and testing that is for *Contractor's* own quality control or is required by regulatory requirements.
- .3 Employment of inspection and testing agencies by *Contractor* or *Owner* does not relieve *Contractor* from responsibility to perform the *Work* in accordance with *Contract Documents*.
- .4 Allow and arrange for inspection and testing agencies to have access to the *Work*, including access to off-site manufacturing and fabrication plants.
  - .1 Co-operate to provide reasonable facilities for such access.
- .5 For inspection and testing required by *Contract Documents* or by authorities having jurisdiction, provide *Consultant* and inspection and testing agencies with timely notification in advance of required inspection and testing.
- .6 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*.
- .7 Provide labour, *Construction Equipment* and temporary facilities to obtain and handle test samples on site.
  - .1 Provide sufficient space to store and cure test samples.
- .8 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 Consultant at no cost to the City. Pay costs for retesting and reinspection.

#### 1.5 INSPECTION AND TESTING AGENCY REPORTS

- .1 Provide reports prepared by inspecting and testing agencies for inspection and testing required by *Contract Documents* or by regulatory requirements, and performed by

*Contractor* retained inspection and testing agencies in accordance with this section Article titled "Action/Information submittals".

- .2 For inspection and testing performed by the City retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to *Contractor*.

## 1.6 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Provide seal of professional engineer on tests and mix designs as specified in the Contract Documents. Engineer to be registered within the Province of:
  - .1 Manitoba.
- .3 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

## 1.7 MOCK-UPS

- .1 Prepare mock-ups of *Work* as specified in the *Technical Specifications*.
  - .1 If a mock-up location is not indicated in the *Drawings* or *Specifications*, locate where directed by *Contract Administrator*.
- .2 Prior to preparation and installation of mock-up, coordinate and schedule pre-installation meetings in accordance with Contract Documents.
- .3 Modify mock-up as required until *Contract Administrator* approval is obtained.
- .4 Approved mock-ups establish an acceptable standard for the *Work*.
- .5 Protect mock-ups from damage until the *Work* they represent is complete.
- .6 Unless otherwise specified in the technical *Specifications*, approved mock-ups forming part of the *Work* may remain as part of the *Work*.
- .7 Remove mock-ups only when the *Work* they represent is complete or when otherwise directed by *Contract Administrator*.
- .8 Technical Specification sections specify whether mock-up may remain as part of *Work* or if it is to be removed and when.
- .9 Prepare mock-ups for *Contract Administrator*'s review with reasonable promptness and in orderly sequence, to not cause delays in *Work*.
- .10 Failure to prepare mock-ups 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.

## Part 2 Products

### 2.1 NOT USED

- .1 Not used

## Part 3 Execution

### 3.1 NOT USED

- .1 Not used

**END OF SECTION**

## **Part 1 General**

### **1.1 SECTION INCLUDES**

- .1 Methods and procedures for deconstruction of structures and parts of structures.

### **1.2 REFERENCES**

- .1 Manitoba Regulation 217/2006, Workplace Safety and Health Regulation.

### **1.3 MEASUREMENT PROCEDURE**

- .1 No measurement will be made for demolition of items to facilitate Work identified as fixed price component.
- .2 Include demolition costs for demolition required to facilitate Work identified as a unit price component.

### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Train workers and subcontractors to carry out work in accordance with appropriate deconstruction techniques.
  - .2 Project supervisor to have previous deconstruction experience and must be present on site throughout project.

### **1.5 SITE CONDITIONS**

- .1 Hazardous Materials:
  - .1 Should material resembling asbestos or other hazardous material be encountered, stop work, take preventative measures, and notify Contract Administrator immediately.
    - .1 Do not proceed until written instructions have been received from Contract Administrator.
  - .2 Notify Consultant before disrupting building access or services.
- .2 Existing Conditions:
  - .1 Ensure that materials, equipment and procedures safely supporting existing structure and construction live loads; that allow work to be accomplished and that minimize risk of damage to historic and archaeological elements.
  - .2 Buildings and concourse will be occupied continuously over the duration of the Work. Access to buildings to be maintained. Protect entrances and egresses.
- .3 Protection:
  - .1 Protect existing structures and services designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to the City.
  - .2 In all circumstances ensure that demolition work does not adversely affect adjacent areas and operations below Work Area.
  - .3 Do not dispose of waste of volatile materials such as, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout the project.

- .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
- .6 Prevent movement, settlement or damage of adjacent structures, services. Provide bracing, shoring. Repair damage caused by deconstruction.
- .7 Support affected structures and, if safety of structure being deconstructed and adjacent structures appears to be endangered, take preventative measures. Cease operations and immediately notify Contract Administrator.
- .8 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.
- .2 Where possible use water efficient wetting equipment/attachments when minimizing dust.
- .3 Protect existing items designated to remain and materials designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Contract Administrator and at no cost to the City.
- .4 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.
- .5 Locate and protect any utility lines which may be affected by the work and if necessary, notify utility companies before starting demolition.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Before starting work, verify existing conditions and variations. Notify Contract Administrator of discrepancies.
- .2 Conduct inspection with Contract Administrator to determine extent of masonry and concrete repair areas.

### **3.2 PREPARATION**

- .1 Take pre-demolition photographs of Work Area prior to demolition.

### **3.3 DISASSEMBLY**

- .1 Conduct demolition to minimize interference with adjacent building areas.
- .2 Maintain protected, wheelchair accessible egress and access at all times to the building entrance.
- .3 Remove debris created by the execution of the Work progressively from the site to appropriate disposal grounds. Do not damage adjacent finishes or surfaces.
- .4 Do not disturb adjacent items designated to remain in place.
- .5 Salvage Materials:
  - .1 Carefully remove and store reusable site materials.
  - .2 Dismantle items containing materials for salvage.

- .3 Stockpile salvaged materials at locations as approved by the Contract Administrator.
- .6 Deconstruct in accordance with Manitoba Regulation 217/2006 and other applicable safety standards.

### **3.4 REMOVAL FROM SITE**

- .1 Transport material designated for disposal to approved facilities in accordance with applicable regulations.
- .2 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

### **3.5 CLEANING AND RESTORATION**

- .1 Keep site clean and organized throughout deconstruction.
- .2 Upon completion of demolition, remove debris, trim surfaces and leave work site clean.
- .3 Upon completion of project, reinstate parking surfaces, walkways, affected by Work to condition which existed prior to beginning of Work and match condition of adjacent, undisturbed areas.
- .4 In addition to the progressive removal of waste materials and debris from building and site, leave the site clean, perform the following before final inspection by the Contract Administrator.
  - .1 spray-wash all exterior building finishes in construction area and any adjacent building areas soiled by the construction processes.
  - .2 Broom clean and wash exterior walks, steps and platforms soiled from delivery or removal materials.
  - .3 Remove all dirt and other disfigurations from exterior surfaces.
  - .4 Sweep clean all paved areas.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 92 10 – Top Surface Concrete Repairs
- .4 Section 03 93 30 – Form and Pour with Repair Mortar

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA O121-17, Douglas Fir Plywood.
  - .3 CSA O151-17, Canadian Softwood Plywood.
  - .4 CSA O153-19, Poplar Plywood.
  - .5 CSA-O325-16, Construction Sheathing.
  - .6 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
  - .7 CSA-O86-19, Engineering Design in Wood.
  - .8 CSA S269.1-16, Falsework for Construction Purposes.

### **1.3 MEASUREMENT PROCEDURES**

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

### **1.4 SUBMITTALS**

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

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, and CSA-O153.
- .2 Pan forms: removable steel, or reinforced plastic to match existing profiles and dimensions.
- .3 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .4 Form release agent: non-toxic, biodegradable, low VOC.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .6 Falsework materials: to CSA-S269.1.

## **Part 3 Execution**

### **3.1 FABRICATION AND ERECTION**

- .1 Fabricate and erect falsework in accordance with CSA S269.1.
- .2 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .3 Align form joints and make watertight. Keep form joints to minimum.
- .4 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .5 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .6 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .7 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

### **3.2 REMOVAL AND RESHORING**

- .1 Notify Consultant 24 hours in advance prior to removing formwork.
- .2 Do not remove forms and bracing until concrete has gained sufficient strength to carry its own weight, construction loads, design loads that are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .3 Leave formwork in place for following minimum periods of time after placing concrete:
- .4 Reshore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.
- .5 Remove formwork progressively and in accordance with Building and Safety Code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- .6 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .7 Store removed forms, for exposed concrete, so surfaces in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .8 Re-use formwork subject to requirements of CAN/CSA-A23.1.

**END OF SECTION**

## Part 1 General

### 1.1 REFERENCES

- .1 ASTM International
  - .1 ASTM A1064/1054M-24, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement , Plain and Deformed, for Concrete
  - .2 ASTM A143/A143M-07(2020), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .2 CSA International
  - .1 CSA-A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3-19, Design of Concrete Structures.
  - .3 CSA-G30.18-09(R2019), Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.20/G40.21-04(R2019), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .3 Reinforcing Steel Institute of Canada (RSIC)
- .4 RSIC-2020, Reinforcing Steel Manual of Standard Practice.

### 1.2 MEASUREMENT PROCEDURES

- .1 No measurements for reinforcing steel will be made for concrete reinforcing and dowel installation identified as work on Drawings. Include reinforcing steel costs in the lump sum price item.
- .2 Where the Contract Administrator directs supplemental reinforcing in addition to that shown on Drawings, the supplemental reinforcing unit price will apply in accordance with Section 01 22 00 – Unit Prices.
- .3 Where the Contract Administrator directs supplemental reinforcing in addition to that shown on Drawings, the supplemental dowels unit price will apply in accordance with Section 01 22 00 – Unit Prices.

### 1.3 SUBMITTALS

- .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba.
    - .1 Indicate placing of reinforcement and:
      - .1 Bar bending details.
      - .2 Lists.
      - .3 Quantities of reinforcement.
      - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.



- .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

## Part 2 Products

### 2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Consultant.
- .2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2. All accessories to be non-corroding or epoxy coated.
- .7 Plain round bars: to CSA-G40.20/G40.21.
- .8 Dowel adhesive: Acceptable products:
  - .1 Hilti HIT HY-200 by Hilti Canada.
  - .2 Sikadur AnchorFix 3001 by Sika Canada Inc.

### 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

### 2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Consultant 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 Consultant 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 indicated or authorized by Consultant.
- .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 Prior to placing concrete, obtain Consultant's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

### **3.3 DOWELING PROCEDURES**

- .1 For bars that are indicated as being dowelled, drill in and grout bars into slab as follows:
  - .1 10M bars, 200mm
  - .2 15M bars, 250 mm
  - .3 20M bars, 300 mm
- .2 Use only approved adhesive to manufacturer's instructions.
- .3 Clean hole thoroughly prior to application of adhesive. Use injection or caulking gun to ensure that the adhesive fills the bottom of the hole prior to embedment of bar.

### **3.4 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 Structural slabs, reinforced slabs-on-grade, structural beams and walls

### **1.2 RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.

### **1.3 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA-A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA-A3000-23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
  - .3 CSA A283-19, Qualification Code for Concrete Testing Laboratories.
- .2 American Concrete Institute (ACI)
  - .1 ACI 309-05, Guide for the Consolidation of Concrete.
- .3 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C260/C260M-10a, Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM C494/C494M-17 Standard Specification for Chemical Admixtures for Concrete.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

### **1.4 MEASUREMENT PROCEDURES**

- .1 No measurement will be made under this section for cast-in-place concrete curbs and pavement.
- .2 Include all costs for concrete required for concrete repairs in appropriate unit prices.

### **1.5 MEASUREMENT PROCEDURES**

- .1 Testing agency Qualifications:
  - .1 Independent third party testing agency certified:
    - .1 In accordance with CSA A283, and
    - .2 By the Canadian Council of Independent Laboratories (CCIL) for the testing procedures specified.

### **1.6 CERTIFICATES**

- .1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

- .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

## 1.7 ABBREVIATIONS

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
  - .1 Type GU or GUb - General use cement.
  - .2 Type CI - with CaO content ranging from 8 to 20%.
- .2 SCM – Supplemental cementing materials.
- .3 SSD - Saturated surface dry.
- .4 WRA – Water reducing agent.

## 1.8 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
  - .1 Modifications to maximum time limit must be agreed to Consultant and concrete producer as described in CSA A23.1/A23.2.
  - .2 Deviations to be submitted for review by Consultant.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

## Part 2 Products

### 2.1 MATERIALS

- .1 The concrete constituents shall comply with the following standards:
  - .1 Cement: to CAN/CSA-A3001.
  - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
  - .3 Supplementary cementing materials: to CAN/CSA-A3001.
  - .4 Water: To CSA-A23.1.
  - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
  - .6 Air entraining admixture: ASTM C260.
  - .7 Chemical admixtures: ASTM C494/C494M. Consultant to approve accelerating or set retarding admixtures during cold and hot weather.

### 2.2 MIX REQUIREMENTS

- .1 Refer to General Notes on Structural Drawings

### 2.3 BONDING SLURRY

- .1 The bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.40 in accordance with CSA-A23.1 and as follows:
  - .1 1.0 kg Type GU to CSA A3001.
  - .2 1.0 kg SSD concrete sand to CSA A23.1.

- .3 0.40 kg Water to CSA A23.1.
- .4 High range water reducing agent to ASTM C494/C494M as required and approved by Consultant.
- .5 Volume batching will be permitted provided the volumes are calibrated by weight prior to batching. The measuring containers shall be clearly labelled, indicating material type, calibrated weight of material, and calibrated volume. The Consultant reserves the right to randomly check batch weights.
- .6 Shovel batching is strictly prohibited.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

## 2.4 ACCESSORIES

- .1 Evaporation retardant: Acceptable Product:
  - .1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
- .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
  - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m<sup>2</sup>/L.
  - .2 MasterKure CC, formerly (Kure-N-Seal) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
- .3 Vapour Barrier: 10 mil polyethylene film to CAN/CGSB-51.34.

## 2.5 GRANULAR BASE

- .1 Comply with City of Winnipeg Standard - CW 3110

## Part 3 Execution

### 3.1 PREPARATION

- .1 Obtain Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .3 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .5 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated. Refer to Section 03 20 00.
- .6 Do not place load upon new concrete until authorized by Consultant.
- .7 Provide formwork and falsework to Section 03 10 00 - Concrete Forms and Accessories.
- .8 Place reinforcing steel and install dowels to Section 03 20 00 - Concrete Reinforcement. Provide dowels at locations shown on the drawings.
- .9 Obtain Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .10 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather. Protection and curing must comply with the hot weather and cold weather requirements of CSA-A23.1.

- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated.
- .13 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .14 Do not place concrete until screed rails for hand operated strike-off devices are in place and firmly secured.
- .15 Rails to be of type, and so installed, that no springing or deflection will occur due to weight of finishing equipment.
- .16 Set rails or headers to elevations to produce deck true to required grade and cross section.
- .17 Use polyethylene film or plastic coated tape if necessary to prevent concrete from bonding to rails.
- .18 Do not treat rails with release agents or parting compounds.
- .19 Subject to approval of the Consultant, screed rail anchors which remain in the concrete may be used provided they are non-corroding and sit a minimum of 30 mm below the finished surface of the concrete.

### **3.2 MIX PRODUCTION**

- .1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
  - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
  - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
  - .3 WRA addition shall occur at the batch plant or on site. For site addition, concrete supplier to provide written notice minimum 2 weeks prior to commencement of concrete work, indicating recommended dosages based on slump at point of discharge.
  - .4 Site addition WRA will be the responsibility of the concrete supplier.
  - .5 Slump and air must be measured both before and after addition of WRA.

### **3.3 PLACEMENT**

- .1 Place concrete work in accordance with CSA-A23.1.
- .2 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.
- .3 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.
- .4 Ensure high points and slopes to drains as shown on drawings are maintained.
- .5 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction

dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.

- .6 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .7 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Consultant.
  - .2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Consultant.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing of concrete.
  - .5 Check locations and sizes of sleeves and openings shown on drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

### 3.4 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1/A23.2.
- .2 Consolidate concrete in accordance with CSA A23.1 and ACI 309.
- .3 Under adverse conditions only, excess bleed water may be removed from the surface using procedures acceptable to Consultant and those noted in CSA-A23.1. Ensure surface is not damaged.
- .4 Immediately after final finishing apply approved evaporation retardant at indicated coverage rate. Evaporation retardant is not to be applied during finishing operations nor should it be worked into the surface.
- .5 Unless otherwise indicated round edges of formed joints in pavements with a 10 mm radius edging tool.

### 3.5 FLATWORK:

- .1 Continuously consolidate and finish to specified elevations, ensuring thickness and required elevations are maintained.
- .2 Use of a floating vibratory screed to consolidate the top surface of the concrete will be mandatory.
  - .1 The use of screed rails may be required to meet required surface tolerances.
  - .2 Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.
- .3 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.
- .4 When the surface is sufficiently set to accommodate the weight of a person with only minor indentation of the surface, and all bleed water has evaporated, **use one pass of a power float surface to smooth out the surface**. A light hand trowel will then be necessary to smooth out irregularities and provide a hard, dense surface.
- .5 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.
- .6 Surface free of all trowel marks and ridges.

### **3.6 VERTICAL FORMED SURFACE**

- .1 Where applicable finishing of formed surfaces shall commence immediately after stripping the forms.
- .2 All form ties and other metal items shall be removed or cut back to a depth of at least 20 mm from the surface of the concrete.
- .3 Patch surface defects as directed by Consultant.
- .4 Unless otherwise indicated in the Schedule of Finishes all formed surfaces shall receive a smooth-form finish in accordance with CSA-A23.1.
- .5 Vertical surfaces of curbs, walls, upstands, etc. shall receive a smooth-rubbed finish in accordance with CSA A23.1.
- .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

### **3.7 SCHEDULE OF FINISHES:**

- .1 Concrete pavement, and exposed curbs subject to foot or vehicular traffic:
  - .1 Class A to CSA A23.1.
  - .2 Texture: Non-slip broomed.
- .2 Top surface concrete repairs to receive hot applied membrane:
  - .1 Class A to CSA A23.1.
  - .2 Texture: surface to be free of all trowel marks and ridges.

### **3.8 JOINTS**

- .1 Location of control and construction joints:
  - .1 Concrete pavements: As shown on Drawings.

### **3.9 CURING**

- .1 Cure and protect concrete in accordance with requirements CSA A23.1.
- .2 Concrete surfaces to be cured at a minimum temperature of 10°C for the entire curing period.
- .3 Curing methods shall be in accordance with CSA A23.1 unless otherwise indicated.
  - .1 Basic curing methods shall consist of one of the following:
    - .1 polyethylene sheet;
    - .2 forms in contact with concrete surface; or
    - .3 curing compounds to ASTM C309 at manufacturer's specified applications rates, when approved by Consultant.
- .4 Requirements for wet-curing:
  - .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
  - .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
  - .3 Commence wet curing with burlap and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one



- layer with strips overlapping at least 75 mm and be securely held in place without marring the concrete surface.
- .4 Wet curing with burlap and water must be maintained for the periods indicated. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Consultant may be necessary.
  - .5 Curing Schedule:
    - .1 Structural concrete work
      - .1 7d at  $\geq 10^{\circ}\text{C}$  and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 4d**.
      - .2 Top surface concrete repairs to receive hot applied liquid membrane:
        - .1 7d at  $\geq 10^{\circ}\text{C}$  and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 7d**.
  - .6 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. Refer to related sections for curing of concrete repair materials.

### 3.10 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 40 00 Quality Requirements and as described herein.
- .2 The Contractor will pay for costs of tests as a unit price per test location.
- .3 Frequency and Number of Tests:
  - .1 Not less than one strength test per 50 m<sup>3</sup> of concrete placed and not less than one test for each class of concrete placed on any one day.
  - .2 Slump and air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.
- .4 The Contract Administrator may take additional test cylinders during cold weather concreting or when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.
- .5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .6 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

### 3.11 DEFECTIVE CONCRETE

- .1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Consultant, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of consultant for each individual use.
- .4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.
- .5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.

- .6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Consultant.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Methods and procedures for cast-in-place concrete topping slab at Richardson Plaza.

**1.2                RELATED SECTIONS**

- .1            Section 03 10 00 – Concrete Forming and Accessories.
- .2            Section 03 20 00 – Concrete Reinforcing.
- .3            Section 03 35 00.01 – Concrete Finishes – Richardson Plaza

**1.3                REFERENCES**

- .1            Canadian Standards Association (CSA)
  - .1            CSA-A23.1-19/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2            CAN/CSA-A3000-23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)
  - .3            CSA A283-19, Qualification Code for Concrete Testing Laboratories.
- .2            American Concrete Institute (ACI)
  - .1            ACI 309R-05, Guide for the Consolidation of Concrete.
  - .2            ACI 117-10, Specification for Tolerances for Concrete Construction and Materials
- .3            American Society for Testing and Materials International (ASTM)
  - .1            ASTM C260/C260M-10a(2016), Specification for Air-Entraining Admixtures for Concrete.
  - .2            ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3            ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
- .4            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

**1.4                MEASUREMENT PROCEDURES**

- .1            No measurement will be made under this section for cast-in-place topping slab.

**1.5                CERTIFICATES**

- .1            Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.
- .2            Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

## 1.6 QUALITY ASSURANCE

- .1 Concrete Installer Qualifications:
  - .1 Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
  - .2 Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
  - .3 Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- .2 Mandatory Pre-Construction Meeting:
  - .1 Minimum 2 working weeks prior to placing concrete for areas scheduled for polishing, conduct conference at Project to resolve mix production, placement, curing and protection, and finishing procedures and responsibilities.
  - .2 Required Attendees include senior representatives of the following:
    - .1 Owner.
    - .2 Contract Administrator, including applicable Sub-Contract Administrators.
    - .3 Contractor, including supervisor.
    - .4 Concrete producer.
    - .5 Concrete finisher, including supervisor.
  - .3 Agenda to include the following:
    - .1 Review Contract Document requirements.
    - .2 Review approved submittals.
    - .3 Review concrete placing and finishing requirements, including, but not limited to:
      - .1 Concrete mix requirements.
      - .2 Properties at fresh concrete.
      - .3 Placement procedures.
      - .4 Jointing procedures.
      - .5 Curing and protection requirements.
      - .6 Finishing requirements and tolerances.
      - .7 Performance requirements of hardened concrete.
      - .8 Protecting concrete floor surfaces
      - .9 Testing requirements.
    - .4 Review reference sample(s) and/or representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
- .3 Mockups:
  - .1 Contractor will be required to produce a mock-up sample of the architectural finishes specified herein and shown on the Materials & Paving Plan using equipment, materials, and procedures planned for the actual construction to Section 03 35 00.01.
  - .2 Any changes in the source materials, mix proportions, or construction procedures after production of initial mock-up, shall require a new mock-up sample and approval review.

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

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
  - .1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
  - .2 Deviations to be submitted for review by Contract Administrator.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
  - .1 Provide an appropriate area on the job site where concrete trucks can be safely washed. Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Contract Administrator.
  - .2 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
  - .3 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

## **1.8 ABBREVIATIONS**

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
  - .1 Type GU or GUb - General use cement.
  - .2 Type CI - with CaO content ranging from 8 to 20%.
- .2 SCM – Supplemental cementing materials.
- .3 SSD - Saturated surface dry.
- .4 WRA – Water reducing agent.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 The concrete constituents shall comply with the following standards:
  - .1 Cement: to CAN/CSA-A3001.
  - .2 Blended Hydraulic cement: to CAN/CSA-A3001.
  - .3 Supplementary cementing materials: to CAN/CSA-A3001.
  - .4 Water: To CSA-A23.1.
  - .5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
  - .6 Air entraining admixture: ASTM C260.
  - .7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

## **2.2 MIX REQUIREMENTS**

- .1 Proportion normal density concrete in accordance with CSA-A23.1.

## **2.3 BONDING SLURRY**

- .1 Bonding slurry shall consist of a cement/sand grout mixed in a 1:1 ratio by weight to a maximum water/cement ratio of 0.40 in accordance with CSA-A23.1.
- .2 Alternative Method: Plastic concrete from same mix utilized for overlying concrete. Scrub plastic concrete. Scrub plastic concrete into substrate with stiff bristled broom or brush to produce a uniform thickness of 3 mm over entire area. Collect and remove all coarse aggregate prior to placement of the overlay.

## **2.4 ACCESSORIES**

- .1 Integral Colour Agent: Integral Color for Ready-Mix Concrete by Interstar.
  - .1 Colour: Smoke Gray (2 bags) – NR-S10SR.
- .2 Evaporation retardant: Acceptable Product:
  - .1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
- .3 Silane Sealer:
  - .1 MasterProtect H 1001 by BASF Building systems.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .3 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .5 At locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated. Refer to Section 03 20 00.
- .6 Do not place load upon new concrete until authorized by Contract Administrator.
- .7 Provide formwork and falsework to Section 03 10 00 - Concrete Forms and Accessories.
- .8 Place reinforcing steel and install dowels to Section 03 20 00 - Concrete Reinforcement. Provide dowels at locations shown on the drawings.
- .9 Obtain Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

- .10 Prior to placing of concrete obtain Contract Administrator's approval of proposed method for protection of concrete during placing and curing in adverse weather. Protection and curing must comply with the hot weather and cold weather requirements of CSA-A23.1.
- .11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated.
- .13 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.
- .14 Do not place concrete until screed rails for hand operated strike-off devices are in place and firmly secured.
  - .1 Rails to be of type, and so installed, that no springing or deflection will occur due to weight of finishing equipment.
  - .2 Set rails or headers to elevations to produce deck true to required grade and cross section.
  - .3 Use polyethylene film or plastic-coated tape if necessary to prevent concrete from bonding to rails.
  - .4 Do not treat rails with release agents or parting compounds.
  - .5 Subject to approval of the Contract Administrator, screed rail anchors which remain in the concrete may be used provided they are non-corroding and sit a minimum of 30 mm below the finished surface of the concrete.

### **3.2 MIX PRODUCTION**

- .1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.
- .2 Concrete to be batched and mixed at a ready-mix plant and delivered to site in ready to place form.
- .3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:
  - .1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.
  - .2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.
  - .3 WRA addition shall occur at the batch plant or on site. For site addition, concrete supplier to provide written notice minimum 2 weeks prior to commencement of concrete work, indicating recommended dosages based on slump at point of discharge.
  - .4 Site addition WRA will be the responsibility of the concrete supplier.
  - .5 Slump and air must be measured both before and after addition of WRA.

### **3.3 PLACEMENT**

- .1 Place concrete work in accordance with CSA-A23.1.
- .2 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.

- .1 The live load capacity of the exterior deck is 4.8 kPa (100 PSF).
- .3 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.
- .4 Ensure high points and slopes to drains as shown on drawings are maintained.
- .5 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.
- .6 Protect freshly placed concrete from exposure to dust, debris and precipitation.
- .7 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Contract Administrator.
  - .2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
  - .5 Check locations and sizes of sleeves and openings shown on drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

### **3.4 FINISHING**

- .1 Finish concrete in accordance with CSA-A23.1/A23.2 and Section 03 35 00.
- .2 Consolidate concrete in accordance with CSA A23.1 and ACI 309.
- .3 Under adverse conditions only, excess bleed water may be removed from the surface using procedures acceptable to Contract Administrator and those noted in CSA-A23.1. Ensure surface is not damaged.
- .4 Immediately after final finishing apply approved evaporation retardant at indicated coverage rate. Evaporation retardant is not to be applied during finishing operations nor should it be worked into the surface.
- .5 Flatwork:
  - .1 Continuously consolidate and finish to specified elevations, ensuring thickness and required elevations are maintained.
  - .2 The use of screed rails may be required to meet required surface tolerances.
  - .3 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.
  - .4 Surface free of all trowel marks and ridges.
- .6 Vertical Formed Surface
  - .1 Where applicable finishing of formed surfaces shall commence immediately after stripping the forms.



- .2 All form ties and other metal items shall be removed or cut back to a depth of at least 20 mm from the surface of the concrete.
- .3 Patch surface defects as directed by Contract Administrator.
- .4 Unless otherwise indicated in the Schedule of Finishes all formed surfaces shall receive a smooth-form finish in accordance with CSA-A23.1.
- .5 Vertical surfaces of curbs, walls, upstands, etc. shall receive a smooth-rubbed finish in accordance with CSA A23.1.
- .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .7 Tolerances:
  - .1 Tolerances shall not be cumulative. Deviations shall not exceed the following when checked with 3.0 m straight edge placed in any direction:
    - .1 Deviation from vertical line – 6mm in 3000mm, 9mm in 6000mm and 18mm in 12000mm or more.
    - .2 Deviation from flat surface (paving) – 3mm in 3000mm.
    - .3 Deviation from horizontal – 3mm in 3000mm
    - .4 Deviation of relative position of columns and walls, thickness of slabs and walls in plan – 6mm.

### 3.5 JOINTS

- .1 Install control joints at locations and according to patterns shown on the drawings. Joints shall correspond to location of slip dowels.
- .2 Location of control and construction joints:
  - .1 Concrete topping slab / pavements: As shown on Drawings.
  - .2 Control joints in upstand walls and curbs to be formed matching joints in adjacent work (spaced at no more than 4500 mm on-centre) and using a 12 mm x 12 mm form strip on each face. Tool in joints along top surface corresponding to form strips.
- .3 Control joints and construction joints shall be tooled at locations shown:
  - .1 Tool control joints to a minimum of 25 mm or one-quarter of the depth of the slab, whichever is greater, following initial set of concrete.
  - .2 Timing of the joint tooling will vary with weather conditions however are typically completed within 1 to 4 hours after final finishing. Timing of the joint cutting will be the responsibility of the Contractor. Cutting joints 24 hours following placement will not be permitted.
- .4 Upon 28-day cure, saw-cut architectural joints 6 mm wide by 12 mm deep.
- .5 Where paving abuts curbs, walls and other vertical surfaces use 12 mm asphalt impregnated fibre board.

### 3.6 CURING

- .1 Cure and protect concrete in accordance with requirements CSA A23.1.
- .2 Concrete surfaces to be cured at a minimum temperature of 10°C for the entire curing period.
- .3 Curing methods shall be in accordance with CSA A23.1 unless otherwise indicated.

- .1 Basic curing methods shall consist of one of the following:
  - .1 polyethylene sheet;
  - .2 forms in contact with concrete surface; or
  - .3 curing compounds to ASTM C309 at manufacturer's specified applications rates, when approved by Contract Administrator.
- .2 Requirements for wet-curing:
  - .1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.
  - .2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
  - .3 Commence wet curing with burlap and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 75 mm and be securely held in place without marring the concrete surface.
  - .4 Wet curing with burlap and water must be maintained for the periods indicated. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.
- .4 Curing Schedule:
  - .1 Concrete paving slabs, slabs-on-grade, sidewalks, and exposed curbs subject to foot or vehicular traffic:
    - .1 7d at  $\geq 10^{\circ}\text{C}$  and for time necessary to attain 70% of the specified strength with a wet-curing period of not less than 3d followed by the application of a cure and sealing compound.
- .5 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure.

### **3.7 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 40 00 Quality Requirements and as described herein.
- .2 The Contractor will pay for costs of tests as a unit price per test location.
- .3 Frequency and Number of Tests:
  - .1 Not less than one strength test per 50 m<sup>3</sup> of concrete placed and not less than one test for each class of concrete placed on any one day.
  - .2 Slump and air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.
- .4 Contract Administrator may take additional test cylinders during cold weather concreting or when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.

- .5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.
- .6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

**3.8 DEFECTIVE CONCRETE**

- .1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.
- .4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.
- .5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.
- .6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

**END OF SECTION**

## **PART 1 General**

### **1.1 SECTION INCLUDES**

- .1 Sandblasted, exposed aggregate and troweled finishes as indicated on the drawings.
- .2 The Contractor shall furnish all labour, materials, equipment and services necessary to complete the Work specified herein.

### **1.2 RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forms and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcement.
- .3 Section 03 30 00.01 – Cast-in-Place Concrete – Richardson Plaza.

### **1.3 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .1 Canadian Standards Association (CSA International)
  - .2 CSA-A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .3 CAN/CSA-A3000-23, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

### **1.4 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittals.
- .2 Test Panels:
  - .1 Minimum 4 weeks prior to commencement of the concrete placement produce test panels to allow assessment and acceptance of the proposed finish.
  - .2 Produce minimum 4 test panels to verify that materials, procedures, and finishes will meet aesthetic requirements.
  - .3 Test panels shall be minimum 900 mm x 900 mm and constructed to incorporate all aspects of the concrete preparation, placement and finishing requirements described in this Section including, but not limited to, edge conditions, and joints.
    - .1 Use same personnel, including supervisors, which will perform the concrete placing and finishing work.
    - .2 Install products and materials according to specified requirements.
  - .4 Each test panel shall be subjected to the minimum curing requirements specified or appropriate for the intended application.
  - .5 If test panels do not meet expectations of colour, aggregate distribution, finish or other required criteria, adjustments shall be made to the mix design and/or the placing/finishing techniques and a new series of test panels shall be constructed.
  - .6 Obtain Owner's approval of test panel before placing concrete.
  - .7 Following acceptance of the test panel and agreement on an allowable deviation range, cut approved test panel into 500 mm x 500 mm 'tiles' to facilitate secure storage and transportation for site comparison.
- .2 The approved panels shall constitute an example of the minimum Workmanship for all Work specified under this section.

- .3 If a sample panel is not approved additional samples will be provided until approved by the Owner or Owner's Representative.

## 1.5 QUALITY ASSURANCE

- .1 Concrete Finisher Qualifications:
  - .1 Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a demonstrable record of 3 successful projects in the last 5 years with proven in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
  - .2 Supervision: Maintain competent supervisor who is at Project during times specified work is in progress.
  - .3 Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- .2 Field Mock-up:
  - .1 A preconstruction field mock-up sample shall be made for each finish using equipment, materials, and procedures planned for the actual construction.
    - .1 The Mock-up Field Samples shall be minimum 2 square metres in floor area for each finish and colour.
    - .2 Use same personnel, including supervisors, which will perform work.
    - .3 Install products and materials according to specified requirements.
    - .4 Work shall be representative of those to be expected for work.
    - .5 Finish various components to show maximum variation that will exist in work.
    - .6 Approval is for following aesthetic qualities:
      - .1 Compliance with approved submittals.
      - .2 Uniformity of exposed aggregate.
  - .2 Obtain Owner's approval before starting work on Project.
  - .3 Protect approved field mock-ups from elements with weather resistant covering.
  - .4 Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
  - .5 Do not demolish, alter, or remove field mock-ups unless directed by Owner.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver aggregate and equipment for seeding or sandblasting to site no longer than one week prior to installation.
- .2 Store aggregates in clearly marked weatherproof containers
- .3 If equipment will be left on site, ensure safe lockable storage area is provided.

## PART 2 Products

### 2.1 MATERIALS & EQUIPMENT

- .1 Water: to CSA-A23.1/A23.2.
- .2 Aggregate: See Section 03 30 00.01
- .3 Sandblasting Equipment: CSA approved, heavy duty portable pressure blasting machine, complete concave top, compressor, mixing valve, couplings, inlet choke and exhaust vales, pressure gauge, pressure relief valve, 12 mm blast hose, tungsten carbide nozzle, and air fed helmet.

- .4 Concrete Groover: 25 mm deep bit, 6 mm wide, with 6 mm radius.
- .5 Concrete Edger: 6 mm radius.
- .6 Sand for sandblasting: 60-100 grit medium glass beads.
- .7 Round end magnesium float.
- .8 Masking Panels: metal or other materials able to withstand the process of exposing the aggregate.

### **PART 3 Execution**

#### **3.1 SCHEDULE OF FINISHES:**

- .3 Concrete pavement, and exposed curbs subject to foot or vehicular traffic:
  - .1 Texture: surface to be free of all trowel marks and ridges.
  - .1 Finish: Light Sandblast.

#### **3.2 SANDBLASTED SURFACES**

- .1 Mask off concrete to be sandblasted with material able to withstand sandblasting operations.
- .2 Ensure a tight seal at masked off edges.
- .3 Sandblast area to produce a CSP-3 profile as described by the International Concrete Repair Institute Inc (ICRI) in an even uniform manner to match sample panel.
- .4 Power wash and clean debris off finished surface.

#### **3.3 TROWELED SURFACES**

- .1 Trowel all surface to a smooth even surface with no pockmarks, seams or imperfections for smooth finishes or areas to receive other finishes. Grind concrete to a smooth finish as directed by the Contract Administrator if formwork and concrete mix fails to produce the desired effect.

#### **3.4 CURING**

- .1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and in accordance with CSA-A23.1/A23.2.

#### **3.5 SEALING**

- .1 Allow slab to dry completely. Clean all surfaces of all sand, surface dust, and dirt, oil, grease, chemical films or coatings, and other contaminants prior to application.
- .2 Apply the sealer as per manufacturers written specifications.

#### **3.6 SITE TOLERANCES**

- .1 Concrete finishing tolerances as per Section 03 30 00.01 to CSA-A23.1/A23.2.

#### **3.7 FIELD QUALITY CONTROL**

- .1 Concrete testing: as per Section 03 30 00.01 and to CSA-A23.1/A23.2.

#### **3.8 ACCEPTANCE**

- .1 Work will only be accepted if it meets approved samples for Workmanship and quality.
- .2 Areas that do not meet these standards must be adjusted or re-poured, as directed by the Contract Administrator until desired finishes are produced.

### **3.9 CLEANING**

- .1 Use trigger operated spray nozzles for water hoses.
- .2 Designate cleaning area for tools to limit water use and runoff.
- .3 Clean concrete of all debris, equipment and tools prior to final inspection and acceptance.

**END OF SECTION**

## **Part 1 General**

### **1.1 SECTION INCLUDES**

- .1 This Section covers the removal of deteriorated concrete and surface preparation for the repair of deteriorated concrete resulting from reinforcing steel corrosion and is applicable to horizontal, vertical, and overhead repairs. Work in this Section includes:
  - .1 Removal geometry and configuration.
  - .2 Removal process.
  - .3 Edge preparation.
  - .4 Reinforcement repair.
  - .5 Surface preparation of the removal cavity prior to placing a repair material.

### **1.2 RELATED SECTIONS**

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 92 10 – Top Surface Concrete Repairs.
- .3 Section 03 93 30 – Form and Pour.

### **1.3 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA- A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CSA A283-19, Qualification Code for Concrete Testing Laboratories.
- .2 International Concrete Repair Institute (ICRI)
  - .1 ICRI concrete Repair Terminology (2010 Edition).
  - .2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
  - .3 ICRI Guideline No. 310.1R–2008, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
  - .4 ICRI Guideline No. 310.2R–2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

### **1.4 MEASUREMENT PROCEDURES**

- .1 No measurement of surface preparation of concrete delamination repair will be made for lump sum identified concrete repairs. Include costs for surface preparation in the appropriate lump sum concrete repair work.
- .2 Refer to applicable Sections for measurement procedures for each type of repair.
- .3 Scanning of concrete for reinforcing steel to accommodate concrete testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.

### **1.5 QUALITY ASSURANCE**

- .1 **Concrete Repair Contractor Qualifications:**
  - .1 Minimum of 5 years' experience in the repair and restoration of concrete structures.
  - .2 Upon request, Provide the following:



- .1 Minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years.
- .2 Minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.
- .3 Site Superintendent:
  - .1 Minimum of 5 years' experience exhibiting successful performance in concrete restoration projects. Provide references upon request.
  - .2 Upon request, Provide the following:
    - .1 Minimum 3 references exhibiting successful performance in concrete repairs within the last 3 years.
    - .2 Successful completion of the Concrete Surface Repair Technician (CSRT) Education course.
  - .4 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.
- .2 **Field Mock-ups:**
  - .1 Upon request, complete a field mock-up for each type of repair. Locations to be site determined.
  - .2 Field mock-up shall be a first placement and incorporate all aspects of the concrete surface preparation described in this Section. Trial repairs areas shall be chosen to include exposure of embedded reinforcing steel.
  - .3 Field mock-up areas will be used as a standard against which subsequent work shall be judged.
  - .4 The field mock-up to be completed by the same personnel completing the repairs.

## Part 2 Products

### 2.1 EQUIPMENT

- .1 Electric or pneumatic chipping hammers are to be used for demolition within the following limits:
  - .1 Initial bulk removal of delaminated concrete above corroded reinforcing steel: maximum 30 lb. electric or pneumatic chipping hammers.
  - .2 Final removal and undercutting of reinforcing steel: maximum 15 lb. electric chipping hammers.
  - .3 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.
- .2 Sandblast equipment shall consist of:
  - .1 Air compressor of sufficient capacity to drive the equipment and blast media selected.
  - .2 Blast media hopper (meters the media into the air stream passing through the hose and nozzle).
  - .3 Moisture and oil separators to insure clean, dry air supply.
  - .4 Blast nozzle and hose.
  - .5 Materials. The blast medium consistent with equipment, site conditions, and capable of obtaining specified surface profile.
    - .1 Media to be non-silica based.

- .3 Low pressure waterblast for final cleaning: capable of maintaining a sustained pressure of not less than 3,000 psi.
- .4 Upon request, provide equipment data sheet in accordance with Section 01 33 00 - Submittal Procedures.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 The location number and extent of repairs shown on Drawings are indicative only. Repair areas will be identified on-site by the Consultant in the presence of and with the assistance of the Contractor. The approximate periphery of the repair will be marked on the surface of the member.
- .2 Right-angle geometry avoiding re-entrant corners and obtain uniformity of depth.
- .3 Provide minimum 48 hours notice. Allow time in the Schedule for survey and inspection work carried out by the Consultant ahead of repairs. Provide sufficient safe access to enable review of all areas designated for repairs.
- .4 Make available as required throughout the Contract labour to carry out the following under the direction of Consultant:
  - .1 Identification of repairs.
  - .2 Sample chipping and/or drilling.
  - .3 Operators for access equipment.
- .5 Make available as required throughout the Contract equipment for the use of the Consultant:
  - .1 Marking paint and chalk.
  - .2 Hammer and chain for sounding surveys.
  - .3 Tape measure.
  - .4 ICRI-CSP profile samples.

#### **3.2 PREPARATION**

- .1 Take precautions to protect the public, occupants of the building.
- .2 Remove or protect all surface attachments (e.g. signs, notices, electrical fittings) from the areas to be repaired or from positions that obstruct access or which may be damaged from Work.
- .3 Carefully store items removed during the course of the works. Reinstall when restoration work is complete.
- .4 Restore to existing condition or better, any damage caused as a result of insufficient protection.
- .5 Provide temporary access required to facilitate Work.
- .6 The Contractor is responsible for confirmation of shoring requirements prior to commencement of, and during demolition.

#### **3.3 CONCRETE DELAMINATION REMOVAL**

- .1 Remove all loose and or delaminated concrete above corroded reinforcing steel.
- .2 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.

- .3 Use chipping to extend concrete removal along reinforcing bars and ensure bars are completely free of corrosion and well bonded to the surrounding concrete. Notify Consultant of increases in areas.
- .4 Where the bond between existing concrete and reinforcing steel has been compromised (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused more than 1/2 the periphery of a bar to be exposed for a distance of 150 mm or more, remove concrete around the periphery of the bar using maximum 15 lb. electric chipping hammers to provide sufficient clearance between the reinforcement and concrete.
  - .1 Provide a minimum 20 mm clearance, or 6 mm larger than the largest aggregate in the repair material, whichever is greater.
- .5 If non-corroded reinforcing steel is exposed, do not damage the bar's bond to the surrounding concrete. If bond between the bar and concrete is compromised, exposing the bar will be required.
- .6 Confirm depth of reinforcing steel prior to sawcutting.
- .7 The perimeter of the areas marked as delaminated are to be saw cut to a depth of 12 mm. Feather edging is not permitted.
- .8 Do not cut reinforcing steel. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.
  - .1 Damage to reinforcing steel caused by the Contractor's negligence will be repaired at no additional cost to the Contract.
- .9 Ensure sawcut encompasses the boundaries of corrosion that have been established.
- .10 Ensure the entire area within the sawcut is removed to a depth consistent with the type of repair and repair material specified in other Sections.
- .11 Chip patch edges to provide a clean vertical edge along the patch perimeter to the required minimum depth.
- .12 Conduct soundings to determine if any further unsound or delaminated concrete is present, which must be removed.
- .13 After all delaminated, unsound, or loose material is removed, request field review from the Consultant. This field review is to be completed in the presence of the Contractor and if any further Work is required, the Contractor is to complete it immediately. The purpose of this field review is to provide assurance to the Consultant that all loose material has been removed and the substrate is sound.
- .14 Care chipping around existing epoxy coated reinforcing, touch up chipped epoxy covering reinforcing steel. Remove bond inhibiting overspray onto adjacent concrete.

### **3.4 SURFACE PREPARATION OF CONCRETE AND REINFORCING STEEL**

- .1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-6 to 10. Sample surfaces are available for inspection in the Consultant's office. These samples will be used as the standard of acceptance.
- .2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.
- .3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust for the full circumference of the bar. SSPC-CSP-6
- .4 Secure any reinforcement which is loose by tying to other secured bars.
- .5 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.

- .6 Maintain substrate in a clean condition using polyethylene film, or similar, until the patch material is ready to be placed.
- .7 After all surface preparation is complete request a field review from the Consultant to review the existing reinforcing steel.
- .8 The Consultant will identify locations for supplemental reinforcing steel. Provide supplemental reinforcing steel to Section 03 20 00.
- .9 Final cleaning of the concrete substrate to consist of a low-pressure waterblast substrate at minimum 3,000 psi to remove any residual dust and dirt.
- .10 Maintain substrate in a saturated condition for at least 2 hours prior to infilling. Refer also to respective repair Sections for additional pre-saturation requirements.
- .11 Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.

### **3.5 FIELD QUALITY CONTROL**

- .1 Coordinate site work and inspections with Consultant. Provide minimum 24 hours notice prior to each phase of the work.
- .2 Consultant field reviews will be completed at the following times:
  - .1 Prior to demolition to identify repair locations and types.
  - .2 Following initial demolition to confirm all loose, deteriorated, or unsound concrete has been removed from the substrate.
  - .3 Following concrete substrate preparation to review concrete surface profile and condition of reinforcing steel.
- .3 Direct pull-out tensile tests of the repair will be completed in accordance with CSA-A23.2-6B periodically throughout the course of the work. Refer to repair Sections for additional requirements.
  - .1 Costs for direct pull-out tensile tests as a unit price in accordance with Section 01 22 00 – Unit Prices and Form B – Prices.
  - .2 Testing agency conducting direct pull-out tensile tests to be certified for CSA A23.2-6B (Procedure A) by the Canadian Council of Independent Laboratories (CCIL).
  - .3 Minimum of three direct tensile tests for each phase of the work.
  - .4 Minimum tensile bond strength not less than 0.9 MPa.
  - .5 Prior to coring for direct pull-out tensile testing, scan substrate to ensure existing reinforcing will not be severed by the testing procedure.
  - .6 Contractor will be responsible for the following where existing reinforcing is severed by the test procedure at no additional cost to the City:
    - .1 Design repair and re-establishment of reinforcing procedure by a professional engineer licenced in the Province of Manitoba.
    - .2 Repair and re-establishment of reinforcing in accordance with the repair procedure.
    - .3 Submit repair procedure to the Contract Administrator for review prior to repair work proceeding.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 The top surface of slabs exhibiting extensive spalling and/or delamination are to be repaired by mechanical removal of the deteriorated concrete and infilling with a rapid-setting mortar.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10.

### **1.2 RELATED SECTIONS**

- .1 03 91 10 - Surface Preparation for Concrete Delamination Repairs

### **1.3 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA- A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .2 ASTM C928/C928M-09, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
- .3 International Concrete Repair Institute
  - .1 ICRI concrete Repair Terminology (2010 Edition).
  - .2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
  - .3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

### **1.4 MEASUREMENT PROCEDURES**

- .1 Top surface repairs identified as a unit price, will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
  - .1 The unit price submitted will apply to removal depths of up to a 75mm and at no point less than 40mm in depth into the structural slab. A second unit price must also be submitted which will apply to removal depths of up to a 150mm depth and at no point less than 75 mm in depth.
  - .2 Minimum payment for repair areas will be 0.1 square metre.
- .2 Concrete testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
- .3 Concrete direct pull-out tensile testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
- .4 Scanning of concrete for reinforcing steel to accommodate concrete testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.

### **1.5 QUALITY ASSURANCE**

- .1 Field Mock-up:

- .1 Install field mock-up at Project site or pre-selected area of building or location approved by Consultant. Install material in accordance with this Section.
- .2 Field mock-up will be standard for judging workmanship on remainder of Project.
- .3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .2 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .3 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .4 Protect materials during storage, handling, and application to prevent contamination or damage.

## 1.7 PROJECT CONDITIONS

- .1 Environmental Requirements:
  - .1 Ensure that substrate surface and ambient air temperature are minimum of 10°C and rising at application time and remain above 10°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
  - .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
  - .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

## Part 2 Products

### 2.1 MATERIALS

- .1 Rapid Setting Repair Mortar: One-component, shrinkage-compensated, cement-based mortar with extended working time for repairing horizontal concrete surfaces.
  - .1 Provide mortar material complying with the following requirements:
    - .1 Compliance: ASTM C928.
    - .2 Compressive Strength, ASTM C109, 2-inch (51-mm) cubes:
      - .1 3 Hours: 3,000 psi (21 MPa).
      - .2 1 Day: 6,000 psi (41 MPa).
      - .3 28 Days: 8,000 psi (55 MPa).
    - .3 Compressive Strength, ASTM C39, 3-inch by 6-inch (76-mm by 152-mm) cylinders:
      - .1 28 Days: 7,400 psi (51 MPa).
    - .4 Splitting Tensile Strength, ASTM C496:
      - .1 1 Day: 400 psi (3 MPa).
      - .2 28 Days: 450 psi (3 MPa).
    - .5 Freeze-Thaw Resistance, ASTM C666, Procedure A, at 300 cycles:
      - .1 100 percent relative dynamic modulus.
    - .6 Scaling Resistance, ASTM C672, at 25 cycles:

- .1 Zero rating; no scaling.
- .7 Length Change, ASTM C928:
- .8 Rapid Chloride Permeability, ASTM C1202:
  - .1 Less than 300 Coulombs.
- .9 Coefficient of Thermal Expansion, CRD C39:
  - .1  $6.8 \times 10^{-6}$  in/in/degree F ( $12.6 \times 10^{-6}$  cm/cm/degree C).
- .2 Acceptable Product:
  - .1 MasterEmaco T 1061 formerly by Sika Canada

## 2.2 ACCESSORIES

- .1 Aggregate Extension: extend mortar material with washed, graded, 3/8 inch (10 mm), low-absorption, saturated surface-dry aggregate at mortar manufacturers recommended rates.
  - .1 For repair areas 2 – 4" (50 – 100 mm) in depth, the minimum recommended addition is 15 – 25 lbs (6.8 – 11.4 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb (22.7 kg) bag.
  - .2 For areas greater than 4" (100 mm) in depth, the minimum recommended addition is 25 – 50 lbs (11.4 – 22.7 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb bag.
  - .3 The maximum aggregate extension is 50 lbs (22.7 kg) of pea gravel per bag.
- .2 Evaporation retardant: MasterKure ER 50 formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
- .3 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
  - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m<sup>2</sup>/L.
  - .2 MasterKure CC 160 WB formerly (Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.
- .2 Surface Preparation:
  - .1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.
- .4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .5 Obtain Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

### 3.2 INFILLING PROCEDURES

- .1 Obtain Consultant's approval before placing repair material. Provide minimum 24 hours notice.

- .2 Maintain the substrate in a saturated surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .3 Mixing of rapid-setting mortar:
  - .1 Mix materials in accordance with manufacturer's instructions.
  - .2 Ensure repair mortar is thoroughly mixed.
  - .3 Do not use free-fall mixers.
  - .4 Never mix partial bags.
- .4 Bonding Slurry Application:
  - .1 Apply the bonding slurry consisting of neat rapid-setting mortar to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove standing water by vacuuming.
  - .2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8" over entire area.
  - .3 Place repair material while the bonding slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.
- .5 Immediately place repair material, into the prepared patch area from one side to the other. Work the repair material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.
- .6 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.
- .7 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.
- .8 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.

### **3.3 FINISHING**

- .1 Following consolidation and screeding, the surface shall be immediately bull-floated to close and smooth the surface.
- .2 Apply evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.
- .3 Protect freshly placed concrete from exposure to dust, debris and precipitation.

### **3.4 CURING**

- .1 Concrete repairs to be cured for a minimum of 3 days at 10°C.
- .2 Immediately after final finishing, apply evaporation retardant to prevent drying shrinkage until the concrete has enough strength to support the placement of the wet burlap.
- .3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.
- .4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" and be securely held in place without marring the concrete surface.
- .5 Wet curing with burlap and water must be maintained throughout entire curing period.



- .6 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.

### **3.5 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Consultant in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.
- .2 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve contractual responsibility.

### **3.6 DEFECTIVE CONCRETE**

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Consultant, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of consultant for each individual use.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 Slab soffit areas, beams, columns and walls exhibiting extensive spalling and/or delamination in which patching would be uneconomical are to be repaired by mechanical removal of the deteriorated concrete and replacement using the form and pour method.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10.

### **1.2 RELATED SECTIONS**

- .1 Section 03 20 00 – Concrete Reinforcing.
- .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 Section 07 92 10 – Concrete Joint Sealants.

### **1.3 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 ACI 546-04, Concrete Repair Guide.
  - .2 ACI RAP-4, Surface Repair Using Form-and-Pour Techniques.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM C109/C109M-23, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (50-mm) Cube Specimens).
  - .2 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 Canadian Standards Association (CSA)
  - .1 CSA- A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .4 International Concrete Repair Institute (ICRI)
  - .1 ICRI concrete Repair Terminology (2010 Edition).
  - .2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
  - .3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).
  - .4 ICRI Guideline No. 320.3-2007, Guideline for Inorganic Repair Material Data Sheet Protocol (formerly No. 03740).

### **1.4 MEASUREMENT PROCEDURES**

- .1 Form and pour repairs identified as a unit price, will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
  - .1 The unit price submitted will apply to removal depths of up to a 75mm and at no point less than 40mm inches in depth. A second unit price must also be submitted which will apply to removal depths of up to a 150mm depth and at no point less than 75mm in depth.
  - .2 The minimum area of payment will be one 0.1 square metre
- .2 Concrete testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.

- .3 Concrete direct pull-out tensile testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
- .4 Scanning of concrete for reinforcing steel to accommodate concrete testing will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
- .5 The minimum area of payment will be one (1) square foot.

## 1.5 QUALITY ASSURANCE

- .1 Field Mock-up:
  - .1 Install field mock-up at Project site or pre-selected area of building or location approved by Consultant. Install material in accordance with this Section.
  - .2 Field mock-up will be standard for judging workmanship on remainder of Project.
  - .3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .2 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .3 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .4 Protect materials during storage, handling, and application to prevent contamination or damage.

## 1.7 PROJECT CONDITIONS

- .1 Environmental Requirements:
  - .1 Ensure that substrate surface and ambient air temperature are minimum of 7°C and rising at application time and remain above 7°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
  - .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
  - .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

## Part 2 Products

### 2.1 MATERIALS

- .1 The repair mortar shall cement-based, one-component, self-consolidating with the following properties:
  - .1 Drying shrinkage to ASTM C157:
    - .1 less than 0.10% at 28 days.
  - .2 Compressive Strength, ASTM C109:
    - .1 1 day: minimum 10.0 MPa.
    - .2 7 days: minimum 28.0 MPa.
    - .3 28 days: minimum 35.0 MPa.
  - .3 Freeze/Thaw Resistance, ASTM C666 at 300 cycles:

- .1 minimum 98% relative dynamic modulus.
- .4 Coefficient of Thermal Expansion, ASTM C531:
  - .1 28 days:  $10 \pm 1.0 \times 10^{-6}$  cm/cm per degree C.
- .2 Acceptable product is:
  - .1 MasterEmaco S 440, by Sika Canada
  - .2 Sikacrete-08 SCC by Sika Canada.

## 2.2 ACCESSORIES

- .1 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
  - .1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m<sup>2</sup>/L.
  - .2 MasterKure CC 160 WB, formerly (Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
- .2 Sealants: to Section 07 92 10

## Part 3 Execution

### 3.1 PREPARATION

- .1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.
- .2 Surface Preparation:
  - .1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.
- .4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .5 Forming:
  - .1 Unless otherwise indicated provide plywood formwork to match existing profiles.
  - .2 Install chamfers at outside corners and filets at inside corners in accordance with Section 03 10 00 or to match existing profiles.
  - .3 Design formwork to accommodate the mass and pressure of the repair material.
  - .4 Securely anchor formwork to substrate. Anchors to be sized and spaced to prevent deflection of the forms placement and curing.
  - .5 Construct forms to fit tightly against existing concrete surfaces. Seal around edge of formwork with sealant to prevent leakage during grouting.
  - .6 Anchors shall be completely removable. All anchor holes shall be patched with grout mixed to dry pack consistency. Completely fill all anchor holes.
  - .7 Placement openings or chutes are required to place the repair material behind vertical forms. Chutes should be constructed to permit development of a hydraulic head above the prepared upper edges of the concrete surface. This will provide for repair material supply into these upper horizontal zones after concrete is consolidated.
  - .8 For large, vertical surfaces exceeding 10 ft (3 m) in height, multiple lifts should be considered to reduce free-fall segregation and excessive formwork pressures.

- .9 Formwork for overhead surfaces does not require openings for placement of repair materials. Place repair materials through openings in the slab from above. Size and location of openings to be approved by Consultant. Do not remove or cause damage to existing reinforcing steel in order to install placement openings.
- .10 A minimum of 40mm concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.
- .11 Provide drainage outlets in formwork for presoaking and, if beneath a soffit, provide air venting. Provide suitable access points to pour mixed repair mortar into place.
- .12 Use form-release agent to facilitate removal of forms from cast material.
- .13 Within two (2) hours immediately prior to placement of repair material, test formwork to determine watertightness. Completely fill formwork with clean water and let stand for not less than 15 minutes. Any areas of leakage are to be sealed prior to placement of repair material. Re-test as required.

### **3.2 INFILLING PROCEDURES**

- .1 Obtain Consultant's approval before placing repair material. Provide minimum 24 hours notice.
- .2 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.
- .3 Mixing:
  - .1 Mix materials in accordance with manufacturer's instructions.
  - .2 Ensure repair mortar is thoroughly mixed.
  - .3 Do not use free-fall mixers.
  - .4 Never mix partial bags.
- .4 Within 15 minutes of mixing, pour repair material into the prepared form. Work in a manner to avoid air entrapment with a variable pressure pump.
- .5 Vibrate the form while pumping, as required, to achieve flow and compaction.
- .6 Ensure that the uppermost surfaces are filled adjacent to the chute or opening where placement occurs. Rod or tamp material to ensure proper filling.

### **3.3 CURING**

- .1 Concrete repairs to be cured for a minimum of 3 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.
- .2 Leave formwork in place until repair mortar reaches compressive strength of 20 MPa

### **3.4 FINISHING**

- .1 After stripping of formwork, any spaces not filled should be trimmed, cleaned, and dry-packed with grout to the desired profile. Do not proceed with repairs without Consultants written approval.
- .2 Prepare surface and paint to match existing.

### **3.5 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 40 00 - Quality Requirements and as described herein.

- .2 The Contractor will pay for costs of tests as a unit price in accordance with Section 01 22 00 – Unit Prices.
- .3 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.
- .4 Not less than one test per 4 square metres of patching material placed and not less than one test for each day of placement.
  - .1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.
- .5 Direct pull-out tensile tests to determine bond strength will be completed throughout the course of the work but not less than the following:
  - .1 Refer to Section 03 91 10
  - .2 The Consultant reserves the right to take additional bond tests if concrete or bonding system is suspect.

### **3.6 DEFECTIVE CONCRETE**

- .1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Consultant, based on the specifications and the above guidelines.
- .3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of consultant for each individual use.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 Materials and installation for hot applied rubberized asphalt (HARA) roofing for roofing and waterproofing in a protected membrane roofing (PMR) systems.
- .2 This Section includes requirements for supply and installation of the following, as required for complete and proper installation:
  - .1 Primer and Hot Fluid-Applied Rubberized Asphalt Waterproofing Membrane
  - .2 Protection Course.
  - .3 Insulation.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C578-19, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - .2 ASTM D2178-15a, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- .2 Canadian General Standards Board (CGSB).
  - .1 CGSB-37-GP-9MA, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .2 CGSB-37.50-M89, Hot Applied, Rubberized Asphalt for Roofing and Waterproofing.
  - .3 CGSB-37.51M90, Application for Hot-Applied Rubberized Asphalt, for Roofing and Waterproofing.
  - .4 CGSB-37-GP-56M, Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate the Work of this Section with the installation of substrate; Sequence work so that installation of fluid-applied membrane waterproofing coincides with installation of substrate preparation without causing delay to the Work.
- .2 Pre-Construction Conference: Arrange a site meeting attended by the Contractor, the Subcontractor, the Contract Administrator, materials supplier(s), and other relevant personal before commencement of work for this Section.
- .3 Review methods and procedures related to installation, including manufacturer's written instructions.
- .4 Examine substrate conditions for compliance with manufacturers installation requirements.
- .5 Review temporary protection measures required during and after installation.

### **1.4 SUBMITTALS**

- .1 Provide requested information in accordance with Section 01 33 00 Submittals Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:

- .1 Product Data: Submit manufacturer's data sheets covering the care and recommended maintenance procedures for incorporation into maintenance manuals.
- .2 Certifications:
  - .1 Submit copies of manufacturers' current ISO certification. Membrane, primers, sealants, adhesives and associated auxiliary materials shall be included.
- .3 Submit references clearly indicating that the manufacturer has successfully completed projects on an annual basis of similar scope and nature for a minimum of fifteen (15) years. Upon request, submit references for a minimum of five (5) projects.
- .4 Submit manufacturers' complete set of standard details for a hot rubberized asphalt waterproofing system showing a continuous plane of water tightness throughout the building waterproofing assembly.
- .5 Provide material checklist complete with application rates and minimum thickness of primary membranes.

## 1.5 QUALITY ASSURANCE

- .1 **Qualifications: Provide proof of qualifications when requested by Contract Administrator:**
- .2 Submit in writing, a document stating that the applicator of the waterproofing specified in this section is recognized by the manufacturer as suitable for the execution of the Work.
- .3 Perform Work in accordance with the manufacturer's written instructions of the waterproofing and this specification.
- .4 Maintain one copy of manufacturer's written instructions on site.
- .5 At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the manufacturers' representative.
- .6 Components used in this section shall be sourced from one manufacturer, including waterproofing, primers, liquid sealants, mastics, adhesives, reinforcement, flashing membrane, drainage board, and protection course.

## 1.6 MOCK-UP

- .1 Construct mock-up 5 square metres minimum size incorporating substrate materials, waterproofing membrane, fabric reinforcement and adjacent materials including flashing, protection course, showing waterproofing membrane application details including typical lap joint, one inside corner and one outside corner.
- .2 Mock-up will be used:
  - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
  - .2 For testing to determine compliance with performance requirements. Perform the following tests:
- .3 Allow 24 hours for review of mock-up by Contract Administrator before proceeding with waterproofing Work.
- .4 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up will remain as part of finished Work.
- .5 Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Contract Administrator specifically notes such deviations in writing.
- .6 Remove and replace materials found not acceptable at no cost to Owner.



## 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Remove damaged materials from the site immediately.
- .2 Store materials in accordance with manufacturer's written instructions, raised off the ground and cover with a weatherproof flame resistant sheeting or tarpaulin.
- .3 Store role materials on end in original packaging.
- .4 Store fluid-applied waterproofing in closed containers outdoors.
- .5 Store adhesives and primers at temperatures of 5 deg C and above to facilitate handling.
- .6 Keep solvent away from open flame or excessive heat.
- .7 Protect products from direct sunlight until ready for use.
- .8 Handle in accordance with sound material handling practices and in accordance with manufacturer's written instructions.

## 1.8 PROJECT/SITE ENVIRONMENTAL REQUIREMENTS

- .1 Temperature, relative humidity, moisture content.
  - .1 Apply HARA membranes only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not install HARA membrane when air and substrate temperature remain below 5 degrees, or when wind chill gives equivalent cooling effect.
  - .3 Install HARA membrane on dry substrate, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into system.
- .2 Protection:
  - .1 Do not permit traffic of any kind over unprotected waterproof membranes. Apply protection course as soon as possible in accordance with manufacturers written instructions.
  - .2 Provide temporary protection of the membrane to prevent mechanical damage or damage from spillage of oil or solvents until such time as permanent protection is provided.
- .3 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of rubberized asphalt, sealing compounds, primers and caulking materials.

## 1.9 WARRANTY

- .1 Manufacturer's Material Warranty:
  - .1 Contractor must warranty that the waterproofing membrane and membrane flashings will stay in place and remain leak proof for two (2) years.
  - .2 Waterproofing membrane manufacturer must warranty the membrane and membrane flashings for leak coverage as a result of faulty materials for a period of ten (10) years from the date of substantial completion.
- .2 Manufacturer's Labour and Material System Warranty:
  - .1 Contractor must warranty the waterproofing membrane and membrane flashings for leak coverage for two (2) years.
  - .2 Waterproofing membrane manufacturer must warranty the membrane and membrane flashings for leak coverage as a result of faulty materials for a period of ten (10) years from the date of substantial completion.
- .3 Manufacturer's Gold Seal Warranty:

- .1 Contractor must warranty the waterproofing membrane and membrane flashings for leak coverage for two (2) years.
- .2 Waterproofing membrane manufacturer must warranty the membrane and membrane flashings for leak coverage as a result of faulty materials or installation workmanship for a period of ten (10) years from the date of substantial completion.
- .4 Submit for Owner's acceptance, manufacturer's warranty document indicated above, executed by an authorized company official.

## Part 2 Products

### 2.1 MANUFACTURER

- .1 Materials and accessories specified herein are manufactured by:
  - .1 Henry Company
  - .2 15 Wallsend Drive, Scarborough, Ontario, Canada, M1E 3X6
  - .3 Phone: (800) 387 9598
  - .4 Website: www.henry.com

### 2.2 MATERIALS

- .1 Waterproofing Membrane: Hot applied, rubberized asphalt composed of a specially selected blend of refined asphalts, synthetic rubber and mineral stabilizers, designed to provide a seamless waterproofing membrane, and having the following physical characteristics.
  - .1 Complies with CAN/CGSB 37.50.
  - .2 Solids Content: 100%
  - .3 Low Temperature Flexibility and Adhesion: No cracking, delamination or loss of adhesion @ -25 deg C (-13 deg F)
  - .4 Water Vapor Permeance (ASTM E96): Procedure E: 0.016 perms (1.0 ng/Pa m<sup>2</sup> sec)
  - .5 Low Temperature Crack Bridging Capability: No cracking, No splitting, No loss of adhesion
  - .6 Specific Gravity: 1.23 +/- 0.03
  - .7 Colour: Black
  - .8 Acceptable Product: 790-11 Hot Applied Rubberized Asphalt by Henry Company.
- .2 Primers: as recommended by manufacturer.
- .3 Fabric Reinforcement: Unsaturated spun bonded polyester mat reinforcement sheet having the following physical properties:
  - .1 Grab tensile strength: MD 107N (24 lbs.); XMD 98N (22 lbs.)
  - .2 Trapezoid Tear: MD 38N (8.5 lbs.); XMD38N (8.5 lbs.)
  - .3 Mullen Burst: 117 kPa (17 psi)
  - .4 Thickness: 0.2 mm (8 mils)
  - .5 Acceptable Product: Polyester Fabric Reinforcement Sheet by Henry Company.
- .4 Flashing and Crack Treatment:
  - .1 Crack Treatment Reinforcement Membrane: SBS modified bitumen membrane having a minimum thickness of 2.90 mils and a non-woven polyester reinforcement of 180 g/m<sup>2</sup>, meeting CGSB 37-GP-56M Type 2 Class C Grade 2.

- .1 Upper and lower surface shall be sanded and be fully compatible with the primary membrane.
- .2 Acceptable Product: modifiedPLUS NP180s/s by Henry Company.
- .5 Protection Course:
  - .1 Horizontal Drainage Composite: Two-part prefabricated geo-composite drain board consisting of a formed polystyrene core covered on one side with a woven or non-woven polypropylene filter fabric:
    - .1 Acceptable Product: Bakor DB 9000 by Henry Company.
    - .2 Designed for demanding horizontal applications in plaza deck, split slab and horizontal flatwork and pavement construction.
- .6 Termination Sealant:
  - .1 Concealed Termination Sealant: Polymer modified sealing compound, compatible with sheet waterproofing membrane, substrate and insulation materials, complies with CGSB 37.29, remains flexible with ageing and chemically resistant to alkalis, calcium chloride, mild acid and salt solutions.
    - .1 Acceptable Product: POLYBITUME 570-05 Polymer Modified Sealing Compound by Henry Company.
  - .2 Exposed Termination Sealant:
    - .1 One-component, moisture cure, medium modulus sealant for construction joints subject to dynamic joint movement.
      - .1 Acceptable Product: HE925 BES Sealant by Henry Company.
    - .2 One-component, high-performance synthetic rubber termination sealant in both vertical and horizontal joints.
      - .1 Acceptable Product: Kop-R-Lastic Thermoplastic Sealant by Henry Company.
- .7 Securement Bars:
  - .1 Securement bars shall be continuous aluminum, stainless steel or galvanized metal, 3 mm x 25 mm x 25 mm in size and shall be pre-drilled for non-corrosive screw attachment on a maximum of 200 mm on-centre.
- .8 Insulation:
  - .1 Extruded Polystyrene rigid board insulation meeting the following properties:
    - .1 ASTM C578, Type VI
    - .2 ASTM E96 Water vapor permeance: 1.1 perms
    - .3 Minimum water absorption by volume per ASTM C272 of 0.1%
    - .4 Minimum compressive strength to ASTM C1621 shall be 40 psi. Refer to Drawings for locations and extents.
  - .2 Acceptable Products:
    - .1 Type VI – Foamular 400 by Owens Corning Canada.
    - .2 Type VI - Highload 40 by Dupont
- .9 Filter Fabric:
  - .1 UV resistant, black woven polyolefin fabric for installation between insulation and stone ballast in protected membrane system. Fabric to meet recommendation of insulation manufacturer.

## 2.3 FIELD QUALITY CONTROL

- .1 Electric Vector Testing (EVT) Quality Assurance Components (Alternate to flood testing):

- .1 Provide electrical wiring, and other components necessary for a testing agency to perform integrity testing of roofing membrane.
- .2 Flood Testing:
  - .1 Flood horizontal roofing installations having a slope which is not greater than two (2) percent slope, as per ASTM D5957.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions:
  - .1 Examine substrates to receive work and surrounding adjacent surfaces for conditions affecting installation.
  - .2 Notify Contract Administrator in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.
- .2 Notify Contractor in writing of any conditions that are not acceptable.
- .3 Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

#### **3.2 PREPARATION**

- .1 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, added laitance or other contaminants. Concrete surfaces shall be free of large voids and spalled areas. Fill areas in substrate to provide an even plane.
- .2 Provide and install prefabricated expansion joint assemblies prior to application of the roofing assembly.
- .3 Cast-in-Place Concrete:
  - .1 New concrete to be minimum 14 days old prior to application of the membrane.
  - .2 Concrete repair areas cast with rapid-setting repair material to be minimum 4 days old prior to application of the membrane.

#### **3.3 INSTALLATION PRIMER AND FLASHING**

- .1 Primer:
  - .1 Apply primer uniformly at the rate recommended by the manufacturer avoiding excessive or over-spraying application. Ponding of the primer is not recommended.
  - .2 The primer shall be dry before applying the hot-applied rubberized asphalt roofing.
- .2 Joint Treatment for Precast Concrete Deck:
  - .1 At joints occurring along the width of the precast units, reinforce with a minimum of 150 mm wide flashing membrane, embedded into a 3 mm thick coat of membrane, centered over joint. Joint width not to exceed 12 mm.
  - .2 Reinforce joints along ends of units with a strip of 300 mm wide flashing membrane, centered over joint.
- .3 Deck to Vertical Junctures:
  - .1 Apply hot-applied rubberized asphalt membrane to provide a thickness of approximately 3 mm to the vertical faces and a minimum of 200 mm out onto the horizontal surface.
  - .2 Embed flashing membrane in the hot-applied rubberized asphalt membrane, avoiding any wrinkles or fish mouths, extending a minimum of 75 mm out onto

- the horizontal surface and 75 mm up vertical. Lap ends of flashing membrane a minimum of 75 mm.
- .3 At monolithic pour, install strip of 150 mm wide Polyester Fabric.
  - .4 Crack Treatment:
    - .1 Treat cracks between 1.5 mm and 3 mm with 150 mm wide strip of polyester fabric set in 3 mm membrane.
    - .2 Treat cracks and joints between 3 mm and 12 mm with 3 mm thick coat of hot-applied rubberized asphalt membrane and strip of 150 mm wide flashing membrane, centered on joint. Extending membrane 75 mm beyond the sheet edges.
  - .5 Expansion Joint Treatment:
    - .1 At expansion joints use adhesive grade reinforcement membrane, loop expansion joint membrane down into joint, embedded into a 3 mm thick layer of hot-applied rubberized asphalt membrane.
    - .2 Ensure that the depth of loop is minimum 1.5 x the joint width. Extend flashing membrane minimum of 150 mm on each side of joint. Seal end joints a minimum of 150 mm and seal with a 3 mm coat of membrane. Fill loop with membrane.
    - .3 In vertical applications secure top of expansion joint sheet with continuous fixing bar at vertical wall locations.
  - .6 Membrane Flashing at Drains:
    - .1 Coat area around drains with hot-applied rubberized asphalt membrane at a thickness of 3 mm.
    - .2 Apply flashing sheet over the coat drain flange extending 150 mm beyond the flange.
    - .3 Apply second coat of hot-applied rubberized asphalt membrane over the flashing sheet at a thickness of 3 mm.
    - .4 Apply clamping ring exerting sufficient pressure to affect a seal between clamping ring and membrane. Temporarily block all drains during the application of ballast, or other materials, which might block the drains. Remove blocking when work is not in progress and upon completion.
  - .7 Membrane Flashing at Protrusions:
    - .1 At mechanical vent, protrusions and pipe flashings provide flashing membrane set into 3 mm layer of hot-applied rubberized asphalt membrane. Overcoat and seal with membrane. Install clamps as required.
    - .2 At pitch pockets, place pan on top of the membrane and attach into roof deck. Set flashing membrane into 3 mm hot-applied rubberized asphalt membrane over top of flange. Fill pitch pocket with hot-applied rubberized asphalt or rubber asphalt sealer to shed water.

### 3.4 INSTALLATION ROOFING AND PROTECTION COURSE

- .1 Hot-Applied Rubberized Asphalt Roofing Membrane:
  - .1 Ensure deck is ready to receive hot-applied rubberized asphalt membrane. Where torch applied flashing membranes have been used, ensure top polyethylene has been scorched away prior to application of the membrane.
  - .2 Apply membrane smooth, free from air pockets, wrinkles, or tears and to manufacturer's instructions. Ensure full bond of membrane to substrate.

- .3 Apply first layer of hot-rubberized asphalt membrane evenly to a minimum thickness of 90 mils to form a continuous monolithic coating over horizontal and vertical surfaces including previously reinforced areas.
- .4 Apply fabric reinforcing sheet and firmly press into first layer of hot-rubberized asphalt membrane. Overlap fabric approximately 6 mm ensuring that a layer of membrane is present between overlaps. Apply second layer of membrane over the fabric to a minimum thickness of 3.2 mm (125 mils) providing a total thickness of 5.5 mm (215 mils).
- .2 Protection Course:
  - .1 SBS modified bitumen membrane:
  - .2 Roll protection course onto hot-applied rubberized asphalt membrane while still warm and tacky.
  - .3 Lap protection course 50 mm on side laps and 150 mm on end laps.
  - .4 Starting at the low points or drains lay the protection course membrane in full continuous sheets in a shingle pattern. Stagger all end laps.
- .3 Asphalt Cover Board:
  - .1 Lay cover board into hot-applied rubberized asphalt membrane while still warm and tacky.
  - .2 Stagger joints between boards and rows.

### 3.5 FINAL INSPECTION

- .1 Notify Contract Administrator when sections of work are complete so as to allow for review prior to installing drainage composite, insulation and ballast.
- .2 Electronic Vector Testing (EVT) (Alternate to Flood Test):
  - .1 EVT to be conducted upon the completion of the roofing assembly and all associated terminations prior.
  - .2 Contact pre-approved test provider several weeks in advance to coordinate schedule.
  - .3 In the event of a breach of the membrane, repair and retest the system in accordance with project specifications.
  - .4 Report results of testing to the Contract Administrator and submit results with the warranty application to Henry Warranty department.
  - .5 No other Work is to proceed without prior direction from the Contract Administrator.
- .3 Flood Test:
  - .1 Conduct flood test upon the completion of the roofing assembly and all associated terminations, as per ASTM D5957.
  - .2 Provide temporary stops and plugs for the roof drains within the test area.
  - .3 Flood test with minimum 50 mm of water for no less than 24 hours.
  - .4 In the event of a breach of the membrane, repair, and retest the system for no less than 24 hours.
  - .5 Remove temporary stops and plugs.
  - .6 Report results of testing to the Contract Administrator and submit results with the warranty application to Henry Warranty department.
  - .7 No other Work is to proceed without prior direction from the Contract Administrator.
- .4 Drainage Board:

- .1 Install drainage board as indicated on the drawings and in accordance with manufacturers written instructions.
- .2 Overlap core flange with core flange of adjacent sheet a minimum of 25 mm and top layer of filter fabric a minimum of 2-12 mm.
- .3 Cut core and fabric to fit tightly around penetrations.
- .4 Install drainage board up vertical flashing to the intended finish grade.
- .5 Insulation:
  - .1 Install insulation as indicated on the drawings and in accordance with manufacturers written instructions.
  - .2 Loose lay and tightly butt all insulation boards together with a maximum 9 mm wide gap between boards and 20 mm wide gap at projections and penetrations.
  - .3 Stagger the end joints of the insulation.
  - .4 Cut the insulation to fit closely to all cants, protrusions and obstructions.
  - .5 When installing multiple layers of insulation, install the thickest layer first. Install the second layer with joints staggered with the layer below.

### **3.6 PROTECTION OF COMPLETED WORK**

- .1 Ensure membrane is undamaged before application of protection board.
- .2 Apply protection board to cover membrane.

### **3.7 CLEANING**

- .1 Progress Cleaning: Leave work area clean at the end of each workday, ensuring safe movement of passing pedestrians.
- .2 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.
- .3 Check area drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from the site.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

- .1 This section covers the installation of an elastomeric joint sealant. The work covered under this section consists of all labour, material, equipment, supervision and incidentals required to prepare and seal the joints and cracks as shown and detailed on the drawings, and as specified herein.

### **1.2 RELATED SECTIONS**

- .1 Section 03 92 10 – Top Surface Concrete Repairs.
- .2 Section 03 93 30 – Form and Pour.

### **1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM C719-14(2019), Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
  - .2 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
  - .3 ASTM C1193-16 Standard Guide for Use of Joint Sealants.
  - .4 ASTM C1330-18 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - .5 ASTM C1521-19(2020) – Standard Practice For Evaluating Adhesion Of Installed Weatherproofing Sealant Joints.

### **1.4 MEASUREMENT PROCEDURES**

- .1 Joint sealants identified as a unit price, will be measured and handled in accordance with Section 01 22 00 – Unit Prices.
  - .1 Unit prices must include all supervision, labour and materials, and equipment. Joints/reglets to be uniform in size over the given length and conform to one of the following configurations. The following unit prices have been requested for miscellaneous joint/crack routing and caulking less than or equal to 12mm in width and greater than 12mm in width.
  - .2 The minimum area of payment will be one 0.3 lineal metre

### **1.5 SUBMITTALS**

- .1 Comply with Section 01 33 00.
- .2 Product Data: Submit manufacturer's technical bulletins and MSDS on each product.
- .3 Samples: For each product exposed to view, manufacturer's standard bead consisting of strips of actual products showing full range of colors available.

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

- .1 The sealant shall be delivered to the jobsite in the manufacturer's original unopened
- .2 Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets for each product.
- .3 Store products in a location protected from freezing, damage, construction activity, precipitation, and direct sunlight per manufacturer's recommendations.



- .4 Handle products with appropriate precautions and care as stated on Material Safety Data Sheet.

## 1.7 PROJECT CONDITIONS

- .1 Environmental Requirements:
  - .1 Ensure that substrate surface and ambient air temperature is above the greater of 4°C or the minimum required by the manufacturer at the time of application and for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.
  - .2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.
  - .3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

## Part 2 Products

### 2.1 MATERIALS

- .1 Type I: Two-component polyurethane joint sealant for control joints in new and existing concrete.
  - .1 Compliance: ASTM C920, Type M, Grade NS, Class 25, Use T.
  - .2 Acceptable products:
    - .1 Sikaflex 2C/NS by Sika Canada Inc.
    - .2 MasterSeal SL2 (Slope Grade) by BASF Building Systems.
- .2 Two-component polyurethane joint sealant for routing and caulking of random cracks and miscellaneous cants below hot-applied waterproofing. Multi-component, non-sag, chemically curing sealant, with consistency suitable for application by hand or pressure caulking gun, or by hand tool. The sealant when completely cured shall form an elastomeric solid capable of maintaining a weatherproof seal.
  - .1 Compliance: ASTM C920, Type M, Grade NS, Class 25, Use T, NT, M, and A.
  - .2 Acceptable products:
    - .1 Sikaflex 2C/NS by Sika Canada Inc.
    - .2 MasterSeal NP2 by BASF Building Systems.
- .3 Type III: Silicone joint sealant for use in control joints: Low-modulus, one-component, non-sag, silicone sealant with consistency suitable for application by hand or pressure caulking gun, or by hand tool. The sealant when completely cured shall form an elastomeric solid capable of maintaining a weatherproof seal.
  - .1 Compliance: ASTM C920, Type S, Grade NS, Class 100/25, Use T, A, M, and O.
  - .2 Acceptable product: NS Parking Structure Sealant by Dow Corning.

### 2.2 ACCESSORIES

- .1 Primers, bond breakers and miscellaneous materials required to install the sealant shall be in accordance with manufacturer's recommendations, and as approved by the Consultant. Use of aggregate bond breakers is prohibited.
  - .1 Primer: Use only manufacturer's approved primer.
  - .2 Closed-cell foam backing rod shall conform: to ASTM C1330.

- .3 Bond breaker tape: self-adhesive, pressure sensitive tape made from TFE-fluorocarbon (Teflon), polyethylene, or similar which will not react with or adhere to the sealant.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Inspect existing caulked joints and cracks to ensure there is no deteriorated sealant, adhesion loss or non elastomeric sealants installed in joints. Remove and replace deficient sealant at location identified by Contract Administrator.

#### **3.2 PREPARATION**

- .1 Substrates must be sound and free of dust, dirt, laitance, paints, oils, grease, curing compounds, or any other contaminants.
- .2 All new concrete surfaces to have minimum compressive strength of 21 MPa and be cured for minimum of 28 days.
- .3 Joint and crack preparation:
  - .1 Sawcut reglet along cracks and joints identified by Contract Administrator.
  - .2 Reglet dimensions are to be site confirmed based on crack dimensions and pattern and be uniform over the given length. The depth of the reglet must be consistent with the type of backing material (ie. bond breaker tape, or backing rod) and sized to produce a width to depth ratio of approximately 2:1.
  - .3 Thoroughly clean joints and reglets by grinding, sandblasting, or wire brushing to expose a sound surface free of contamination and in order to provide a clean, sound substrate for optimum seal adhesion.
  - .4 Remove loose particles present or resulting from grinding, abrading, or blast cleaning by blowing out joints with oil-free compressed air, or vacuuming prior to primer application.
  - .5 Ensure that surfaces to be sealed are sound, dry, free from dirt, water, frost, loose scale, corrosion, oil, grease, waterproofing or water-repellent treatments, or other contaminants which may adversely affect the performance of the sealing materials.
  - .6 If the substrate is suspected of being substandard, an on-site trial application is to be conducted to verify that the substrate is satisfactory. Work will not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the manufacturer. All costs associated with verification to be carried by Contractor.
  - .7 Prior to installation of the sealant an inspection of both the joint and substrate is required to confirm the joint design and to ensure that the substrate is sound and acceptable for sealant application. A substrate that is unsound, cracked, or weak must be repaired prior to sealant.
  - .8 Do not proceed with Work until any unsatisfactory conditions have been corrected in a manner acceptable to the Consultant.

#### **3.3 INSTALLATION**

- .1 Primer: Unless otherwise approved by the sealant manufacturer, priming of all substrates is mandatory.
  - .1 Prime substrates as recommended by the sealant manufacturer.
  - .2 Primer to be installed prior to installation of the sealant backing.

- .3 Allow primer to dry until all the solvent evaporates. This typically takes 15 to 120 minutes, depending on temperature and humidity.
- .4 Prime only those surfaces that will be sealed with sealant the same day. If a previously primed surface that was performed the day before is encountered it must be reprimed.
- .2 Sealant backup: Where joint depth requires backup, pack joints continuously with closed cell backer rod meeting ASTM C1330
  - .1 Backer rod to be installed under adequate compression to hold it in-place in the joint opening and to resist the pressure applied when tooling a non-sag sealant into place. Backer rod diameter to be at least 25% greater than the joint width.
  - .2 Do not install backer rod with a sharp tool which could puncture the rod. Ensure surface skin of the backer rod is not punctured or cut during installation. A puncture in the backer rod may result in out-gasing into the uncured sealant resulting in voids or other defects in the cured sealant.
  - .3 Install backer rod without stretching.
  - .4 Under no circumstances should backer rod that is too small for the joint be doubled up or braided together to fit the opening.
- .3 Bond breaker: A bond breaker will be required in the bottom of all joints containing a rigid, non-flexible backing material to preclude three-side adhesion where movement will occur. A bond breaker is not required to prevent a sealant from adhering to a soft, flexible, sealant backing material that would not significantly restrict movement.
  - .1 Install bond breaker tape in joint to be sealed on top of back-up material to prevent adhesion of sealant to back-up material. The tape shall be installed continuously with no skips or voids in the tape application.
- .4 Mixing:
  - .1 Prepare sealants that require mixing; follow manufacturer's recommended procedures, mixing thoroughly.
  - .2 Mix only as much material as can be applied within manufacturer's recommended application time period.
  - .3 Mix in a manner to prevent inclusion of foreign materials.
- .5 Sealant installation:
  - .1 Apply sealants only within manufacturer's specified application life period. Discard sealant after application life is expired or if prescribed application period has elapsed.
  - .2 Application of sealants must be completed by skilled applicators installed in accordance with manufacturer's printed directions and this Section.
  - .3 Apply sealants to meet Specification and design requirements [as shown on Drawings].
  - .4 Do not install sealant on wet or damp substrates. Wet or damp substrates should be allowed to dry before application of primer and/or sealant.
  - .5 Do not install sealants under conditions of precipitation or temperatures below 4°C. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.
  - .6 All sealants have a temperature range for optimum handling which can vary considerably, and should be stored at a temperature within this range for at least 4 hours before use.
  - .7 Do not use sealant that has started to set in its container, exceeded shelf life or installation times as stated by the manufacturer.

- .8 Sealant to be installed in a manner that will completely fill the cavity formed in the joint opening by the substrates and sealant backing or bond breaker.
- .9 Apply sealant by any of the common types of hand operated guns. Nozzles shall be sized and shaped to fit the intended joint opening width, which will confine the sealant to the joint and aid in building pressure to force the sealant into the cavity. joint. Ensure that mixing and placing procedures do not entrain air within the sealant.
- .10 Immediately after applying the sealant, tool the bead. Tooling forces material into cavities and into more intimate contact with the substrate. Wet tooling will not be permitted.
- .11 Tool sealant to produce a concave shaped surface. Specifically, the sealant and concrete are to be flush at the edges but recessed at the joint centre, forming a parabolic arc. Do not re-use any material forced outside of the joint by the tooling procedure.
- .12 Sealant bead to be free of air pockets, embedded impurities, and free of ridges, wrinkles and sags.
- .13 Use anti-tack solutions only with the approval and directions of the sealant manufacturer.

### 3.4 CLEANING

- .1 Do not clean inadvertent spills or splatters of sealant on concrete or masonry with solvent because of possible permanent staining of the substrate. Scrape, wipe or scrub such spills with dry tools or rags.
- .2 Clean bulk caulking guns, barrel and nozzle completely after every day's use.
- .3 The special precautions recommended by the manufacturer shall be rigidly followed where hazardous materials are involved.

### 3.5 FIELD ADHESION TESTING

- .1 Field adhesion testing of miscellaneous joints and cracks will be complete at the discretion of the Contract Administrator.
- .2 Field adhesion testing will be performed during the field mockup and throughout the course of the work by the Consultant in the presence of and with the assistance of the Contractor and be completed throughout the course of the Work.
- .3 Field adhesion testing:
  - .1 In accordance with ASTM C1521.
- .4 Sealant joint fill Inspection:
  - .1 The joint will be inspected for complete fill:
    - .1 Joint should not have voids.
    - .2 Joint dimensions to match those shown on the Drawings.
- .5 Repair of Sealant at Field Adhesion Test Locations
  - .1 Repair the sealant pulled from the test area by applying new sealant to the test area.
    - .1 Where acceptable adhesion was attained: Use the same application procedure to repair the area as was used originally for the joint. Care should be taken to ensure that the original sealant surfaces are clean and that the new sealant is in contact with the original sealant.
  - .2 Contractor shall carry costs associated with sealant testing and repair in their bid.

**END OF SECTION**

**Part 1      General**

**1.1      GENERAL**

- .1      The word "provided" shall mean "supply and install" unless otherwise indicated.
- .2      Provide new materials, equipment and plant of proven design and quality and of current models with published ratings for which replacement parts are readily available.

**1.2      SCOPE OF WORK**

- .1      The Work included in this Contract shall include the furnishing of all labour, materials, equipment, plant tools and services necessary for, and incidental to the supply, installation and completion of installation to the full intent of the Drawings and as hereafter specified.
- .2      Fire Protection
  - .1      Work shall include, but is not necessarily limited to installation of the following:
    - .1      A wet pipe sprinkler system.
    - .2      A dry pipe sprinkler system.
    - .3      Fire Pump

**1.3      DRAWINGS AND SPECIFICATIONS**

- .1      Not intended to show structural details or architectural features.
- .2      Except where dimensioned, indicates general mechanical layouts only. Do not scale.
- .3      The Mechanical Trade Contractor shall check the content of all architectural, structural, mechanical and electrical Drawings and Specifications, and review these documents for coordination of clearances available for equipment and services, required equipment power supplies and equipment quantities. Before proceeding, report to the Consultant any error or omission, or lack of coordination between the plans and Specifications.
- .4      These Specifications are to be considered as an integral part of the Drawings which accompany them, neither the drawings nor the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other, shall be considered properly and sufficiently specified and must, therefore, be provided under the Contract. The decision of the Consultant shall be final, if interpretation is required.
- .5      Misinterpretation of Drawings and Specifications shall not relieve the Mechanical Trade Contractor of responsibility.
- .6      Fire Protection Contractor(s) shall make themselves familiar with the overall intended operation of the mechanical systems prior to installation so that all necessary accessories such as vents, valves, drains, etc., can be installed during the normal progress of the work. Failure to do so will result in Contractor's

responsibility in providing such devices, at his expense when the need of such devices becomes apparent during start-up.

#### **1.4 GUARANTEES**

- .1 This Mechanical Trade Contractor shall guarantee all his work free from defects for a period of 1 year, unless specifically noted otherwise, after final acceptance of such work by the Owner and shall make good all defects other than normal wear and tear during the life of the guarantee. This Mechanical Trade Contractor shall guarantee all work and equipment supplied by him to work quietly and satisfactorily and to accomplish the work for which it was installed during the life of the above guarantee. At any time during this period, he shall make any necessary changes and adjustments or replacements, to accomplish this at his own expense.
- .2 Submit manufacturers' written guarantees to Architects.
- .3 Bind guarantees in hard cover report binder suitable for 8-1/2" x 11" sheets. Label cover "Guarantees" and show project name. Provide title sheet and table of contents.
- .4 Each guarantee shall include:
  - .1 Project name and address.
  - .2 Guarantee time period (commencement date shall be as date shown on Project Final Certificate of Completion unless otherwise indicated).
  - .3 Clear and concise definition of what is guaranteed and remedial action provided.
  - .4 Signatures of Mechanical Trade Contractor and a company officer of the manufacturing firm.
  - .5 Include all extended guarantees (and service contracts) as specified in individual sections.

#### **1.5 PERMITS AND REGULATIONS**

- .1 All Mechanical Trade Contractors shall comply with all regulations of authorities having jurisdiction, where applicable, including but not limited to the following:
  - .1 Provincial Department of Labour.
  - .2 Provincial Fire Marshal.
- .2 The Mechanical Trade Contractor shall obtain and pay for any permits required by Local Codes and Regulations and arrange for inspections.
- .3 Any additional materials or labour required to conform to any of these rules and regulations will be furnished under the Contract with no additional cost to the Owner.

#### **1.6 REFERENCE STANDARDS**

- .1 Use following latest editions and amendments in effect on date of Tender call:
  - .1 CSA Canadian Standards Association
  - .2 CUA Canadian Underwriters' Association
  - .3 NBC National Building Code of Canada

.4	NFPA	National Fire Protection Association
.5	UL	Underwriters' Laboratories
.6	ULC	Underwriters' Laboratories of Canada
.7	CGSB	Canadian Government Standards Board

## **1.7 CO-ORDINATION**

- .1 Co-ordinate work with other trades to avoid conflict and minimize the requirement for wall and ceiling mounted access doors.
- .2 Locate distribution systems, equipment and materials to provide minimum interference and maximum useable space.
- .3 Co-ordinate location of pipe drops and risers with trades erecting walls and ceilings to ensure that all pipes are concealed in walls or ceilings spaces. If space is not available in walls or ceilings, locate pipes so that they can be easily boxed in by the relevant trades. Where pipes are shown rising in concrete block walls, placement of the pipe shall be done in conjunction with the erection of the wall.
- .4 Fire Protection Contractor(s) shall consult with structural requirements and other Mechanical Trade Contractors where their respective installations conflict and shall re-route pipes or re-locate equipment as required subject to the approval of the Consultant.
- .5 Fire Protection Contractor shall obtain co-ordination Drawings showing main conduits and piping from other mechanical, electrical and other Trades and shall be responsible for pointing out any discrepancies or reasons why they cannot be adhered to.

## **1.8 ALTERNATES**

- .1 Wherever an item or class of material is specified exclusively by trade name of maker or by catalogue reference or under "Acceptable Products", only such item shall be used unless the Architect's or Consultant's approval for an alternative is secured in writing.
- .2 Should the Fire Protection Contractor desire to substitute another material for one or more specified by name, he shall apply in writing for such permission at least 2 Calendar Days before closing date of Fire Protection Tenders. He shall also provide data and/or samples for the Consultant's consideration. Alternate requests will not necessarily be addressed through addendum, but will be confirmed or rejected by the Consultant in writing.
- .3 Equipment submitted as alternate to that specified on the Drawings or in the Specifications by model number or catalogue reference must be capable of meeting the full range of operating parameters as the specified equipment. It must also be configured and set to meet the specific design point parameters as called for on the plans or in the Specifications.
- .4 Fire Protection Contractor shall note that all layouts on the Drawings are based on the specified equipment and any changes necessitated in service connections, etc., will be done at the Fire Protection Contractor's expense. Furthermore, if it is found that the provisions made regarding space conditions are not met, the right

is reserved by the Consultant to require installation of the equipment used on the layout.

- .5 Definitions:
  - .1 Acceptable Products
    - .1 Any product mentioned may be used provided it meets; or
    - .2 Exceeds the quality, performance capability, and space requirements of the equipment shown and called for on the plans and in the Specifications.
  - .2 Standard of Acceptance – Only the product mentioned may be used unless alternate products are approved by the Consultant.

## 1.9 SHOP DRAWINGS

- .1 This Mechanical Trade Contractor shall shop drawings for the following equipment in pdf format:
  - .1 Alarm Valve(s)
  - .2 Fire Department Connection(s)
  - .3 Fire Pump and controller
  - .4 Fire Pump Test Connection
  - .5 Flexible Connections
  - .6 Jockey Pump and controller
  - .7 Pipe and Pipe Fittings
  - .8 Pipe Hangers
  - .9 Pressure and Flow Switches
  - .10 Sprinklers and Sprinkler Guards
  - .11 Sprinkler Systems
  - .12 Valves
- .2 Fire Protection
  - .1 Piping layout Drawings shall be done using latest version of AutoCAD
  - .2 Drawings to be done to the requirements of NFPA 13 the edition of NFPA 13 approved for use in Iqaluit.
  - .3 In addition to these requirements, provide cross sections in different areas such as bulk heads, skylights, special ceilings, etc.
  - .4 For hydraulically designed systems, provide form sheets, including summary sheet, showing hydraulic calculations, all in accordance with NFPA 13.
  - .5 Provide a graphic representation of the complete hydraulic calculation plotted on semi-logarithmic graph paper in accordance with NFPA 13.
  - .6 Provide full information on the water supply as called for in NFPA 13.
- .3 All such Drawings shall be submitted to the Architect for review and the work shall not commence until such review has been obtained.
- .4 The Consultant's review of these Drawings is general. It is not intended to release the Mechanical Trade Contractor from necessity of furnishing systems/equipment



of adequate capacity and power supply and performing the work as required by the plans and Specifications.

- .5 All Shop Drawings must be checked against the requirements of the plans and specifications by this Fire Protection Contractor prior to forwarding them to the Architect. Appendix A at the end of this Section must be completed and signed and must accompany all Shop Drawing submissions. Submissions not accompanied by Appendix A will be returned for re-submission.
- .6 All Shop Drawings must be first quality reproductions with all details, lettering, etc. distinct and legible.
- .7 Where Drawings and Specifications use the imperial system of measure, all design data, capacities, sizes and dimensions specifically called for on the Drawing or in the Specifications will be submitted in like terms on the Shop Drawings.
- .8 All Shop Drawings, other than standard manufacturers dimensions and data sheets, shall bear the stamp of a registered professional Engineer who shall be fully responsible for the Engineering content of such Drawings. Where such Drawings are prepared in Nova Scotia and/or apply to products to be manufactured in Nova Scotia, the Engineer shall be a member of APENS.

#### **1.10 PACKAGED EQUIPMENT**

- .1 The Mechanical Trade Contractor shall note that whenever package equipment is specified it is intended that this equipment shall be a complete package with all necessary accessories to allow for safe automatic operation.
- .2 These accessories shall include all necessary starters, disconnects, relays, transformers, pressure switches, sensors, timers, etc. Where subject to the weather, the device shall be enclosed in a "weatherproof" enclosure.
- .3 Fire Protection Contractor shall be responsible for checking with the supplier of the equipment to ensure that the packaged equipment is complete with all necessary accessories. He shall also determine which accessories are factory mounted and which ones are shipped loose with the equipment. Fire Protection Contractor shall include in his Tender an amount for all necessary wiring and piping, etc. necessary to incorporate any pieces of equipment, which are shipped separately into the job, at no additional cost to the Owner.
- .4 Disconnect switches shall not obscure manufacturer's nameplate data.
- .5 Fire Protection Contractor shall note that this refers to all packaged equipment including, pumps, etc. and it shall be his responsibility to co-ordinate this with the supplier of the equipment and to either have the supplier include an amount in his price or the Mechanical Trade Contractor shall include the necessary amount to ensure the supply and installation of any accessories necessary for the operation of this equipment.

#### **1.11 ELECTRICAL CONNECTIONS, MOTORS AND STARTERS**

- .1 Where motors for pumps, or other mechanical equipment is connected to Variable Speed Drives, premium efficiency inverter duty type motors are to be installed.
- .2 Electrical equipment shall bear CSA Label. Obtain special inspection labels required by Provincial Authority having jurisdiction.

- .3 Fire Protection Contractor is to review electrical drawings and ensure that equipment power supplies match those indicated on the Electrical Trade Contractors Drawings and Specification. Bring all discrepancies to the attention of the Consultant prior to ordering equipment.
- .4 Use 1,750 rpm, open drip-proof, ball bearing motors manufactured to CEMA standard for 40°C temperature rise and designed for continuous service and vibration free, quiet operation.
- .5 Where motors may be subject to high moisture levels such as in areas subject to washdown, such motors will be splashproof or totally enclosed fan cooled.
- .6 Conform to requirements of Canadian Electrical Code, Division 26 Specifications, Local and Municipal and Provincial Authorities, and specified standards.
- .7 All equipment not located in mechanical rooms shall be supplied complete with a disconnect switch. Where exposed to the weather, "weatherproof" disconnects shall be provided.

#### **1.12 CUTTING AND PATCHING**

- .1 Cutting and patching for interior services to be performed by the Fire Protection Contractor. Cutting and patching of the building envelop is by the General Contractor.
- .2 Make every effort to minimize cutting and patching and provide dimensions, locations and other data for bases, sleeves, boxes, etc., to be built in as construction proceeds. Set sleeves and make openings in concrete forms and masonry before placing concrete and masonry.

#### **1.13 SLEEVES AND ESCUTCHEONS**

- .1 Sleeves:
  - .1 Unless otherwise specified, supply pipe sleeves for all points where pipe passes through masonry or concrete walls or floors. Sleeve shall be supplied by the Fire Protection Contractor and built-in by appropriate trade.
  - .2 Unless otherwise specified, construct sleeve of galvanized sheet steel with lock seam joints of minimum 16 gauge.
  - .3 Use cast iron or galvanized steel pipe sleeves with perimeter fin continuously welded at mid point.
    - .1 Through foundation walls.
    - .2 Where sleeve extends above finished floor.
  - .4 In kitchens, washrooms and other wet areas where water from spills or leaks may penetrate the floor slab, sleeves to be Schedule 40 pipe and extend 1" above the finished floor. In all other areas, sleeves shall be flush with the finished floor.
- .2 Sizes:
  - .1 Provide approximately ½" clearance, all around, between sleeve and pipes or between sleeve and insulation.

- .2 Through footings use sleeves large enough to accommodate hub of CI soil pipe.
- .3 Where piping passes below footings, provide minimum all round clearance of 2" between piping and sleeves. Backfill up to underside of footing with concrete of same strength as footing.
- .4 Unless otherwise specified, terminate sleeves flush with walls and ceilings.
- .5 Sleeves shall be sized to accommodate the insulated pipe diameter.
- .3 Unless otherwise indicated for pipes passing through roofs, use galvanized or cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make watertight durable joint.
- .4 Caulking:
  - .1 Caulk sleeves in foundation walls and below grade floors with oakum and lead between sleeve and pipe, or use Link-Seal hydrostatic seal.
  - .2 Where sleeves pass through foundation walls or on grade slab floors, caulk space between insulation and sleeve or between pipe and sleeve with dry oakum. Seal space at each end of sleeve with non-hardening mastic.
- .5 Escutcheons and Plates:
  - .1 Provide on pipes passing through finished walls, partition floors and ceilings.
  - .2 Use chrome or nickel plated brass, either split or solid type, with set screws for ceiling or wall mounted. For equipment room use cast iron type.
  - .3 Inside diameter shall fit around finished pipe insulation or uninsulated pipe. Outside diameter shall cover sleeve.
  - .4 Where sleeve extends above finished floor, escutcheons or plates shall be bell shaped to cover the sleeve extension.
  - .5 Secure to pipe or sleeve but not to insulation.
- .6 Penetrations of Fire Separations:
  - .1 Where pipes pass through walls or floors which provide either rated or nonrated (smoke barriers), seal around openings with ULC classified fire stop material. Material shall be installed to manufacturers' recommendations and shall provide a fire rating equal to that of the separation which has been penetrated.
  - .2 Acceptable Products:
    - .1 Dow Corning Fire Stop System
    - .2 3M Fire Barrier Penetration Sealing System
    - .3 Bio-Fire Biotherm or Bio-K10 (Supplied by Wormald)
    - .4 Hilti Fire Stop System

#### **1.14 BASES AND SUPPORTS**

- .1 Concrete bases are by the General Contractor.
- .2 Concrete bases will be required under all floor mounted equipment including equipment with attached skids and bases unless otherwise noted. All such bases will be 4" deep and will be 4" larger in all directions than the equipment being supported.
- .3 Where equipment is raised above the floor it will be supported by means of angle iron, I beams or pipe. All such supports shall be anchored to the floor and shall have a metal base to spread the load. These supports shall be cross-braced with diagonal members.
- .4 Where equipment is suspended from the structure provide appropriately sized hanger rods, channel iron or angle iron hangers. Distribute the weight of the units uniformly across the structure, consistent with the design loading for the structure and as approved by the Consultant.
- .5 Where structure has not been designed to support equipment, this Mechanical Trade Contractor shall provide pipe stands or angle iron supports to support the equipment from the floor.
- .6 Unless specifically noted otherwise, provide spring isolators under all floor mounted vibrating, rotating or oscillating equipment designed to eliminate 90% of the vibration from being transmitted to the structure. For similar suspended equipment, provide spring hangers.

#### **1.15 PAINTING**

- .1 Piping and equipment identification, glue and sizing and touch-up painting is the responsibility of the Fire Protection Contractor.
- .2 Apply to hangers, supports and equipment fabricated from ferrous metals at least 1 coat of corrosion resistant paint before shipment to job Site.
- .3 Touch-up damaged finish surfaces to satisfaction of the Consultant. Use primer or enamel to match original. Do not paint over nameplates.

#### **1.16 SPECIAL TOOLS AND SPARE PARTS**

- .1 Furnish spare components as per NFPA 13 and as specified.
- .2 Identify spare parts containers as to contents and replacement parts number.
- .3 Provide one set of all tools required to service equipment as recommended by manufacturers.
- .4 Upon handover of spare parts to the Owner, obtain the signature of the Owner's representative on the list of spare parts confirming receipt of the spare parts. Provide a copy of the signed list to the Consultant.

#### **1.17 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS**

- .1 Provide factory trained personnel to instruct operating staff on maintenance, adjustment and operation of mechanical equipment. Instruct staff on changes or modification in equipment made under terms of guarantee.

- .2 Provide instruction during regular work hours prior to acceptance and turn over to operating staff for regular operation.
- .3 Prepare a maintenance schedule which will advise the Owner's staff what maintenance must be done and the suggested intervals at which it should be done.
- .4 Provide 3 copies to the Owner of the maintenance manual suitably bound with hard covers, 8½" x 11". Binders shall be thick enough to hold literature flat. Where necessary, provide 2 binders.
- .5 Provide an electronic copy of the Maintenance Manual in pdf format to the Owner on CD, USB Memory Stick, via e-mail, DropBox, or other mutually agreed file sharing method. Maintenance Manual shall be divided into multiple files, each file or folder corresponding to a Section/Tab. Files and Folders shall have logical names and Files shall be searchable by the pdf reader.
- .6 The maintenance manual shall include the following:
  - .1 Have a title sheet, or sheets, preceding data on which shall be recorded Project name, date, list of contents, and Trade Contractor's name.
  - .2 Be organized into applicable Sections of work with each Section separated by hard paper dividers with plastic covered tabs marked by Section.
  - .3 Contain a list of local (or nearest) representative of each piece of equipment including address and phone number.
  - .4 One copy of each final approved Shop Drawing on which have been recorded changes made during fabrication and installation.
  - .5 Typed or printed information and notes, and neatly drafted Drawings.
  - .6 Separate Tab for all MSDS sheets.
- .7 Maintenance and operating instructions on all building equipment supplied by the Mechanical Trade Contractor.
- .8 Maintenance instructions as by the equipment manufacturer.
- .9 Brochures and parts lists on all equipment as supplied by the equipment manufacturer.
- .10 Sources of supply for all proprietary products used in the Work.
- .11 Lists of supply sources for maintenance of all equipment in the project of which more detailed information is not included above.
- .12 List of recommended spare parts.
- .13 Submit all guarantees and extended guarantees together in a separate binder.
- .14 Material Safety Data Sheets (MSDS) for all chemicals remaining as part of the finished building (e.g., glycol, pipe treatment, etc.).
- .15 Material Safety Data Sheets (MSDS) for all chemicals supplied including, but not limited to fire extinguishing agents.

## **1.18 COMPLETION**

- .1 Nothing herein contained can be constructed to relieve the Trade from making good and perfect Work in all usual details of construction and in accordance with

best standard practice and in strict compliance with provisions of any and all laws and ordinances, and the rules and regulations of any duly constituted public body having jurisdiction over this Work.

- .2 This Trade shall be held responsible to provide and furnish all necessary labour and to bear all expenses incidental to the satisfactory completion of the Work.

### **1.19 RECORD DRAWINGS**

- .1 One set of white prints and one set of reproducibles will be provided for record drawing purposes. Maintain project "as-built" record Drawings and accurately record significant deviations from the Contract Documents, caused by Site condition or Contract change. Mark changes on white prints in "RED". At the completion of the projects, and prior to final inspection, neatly transfer "as-built" corrections and notations to clean document, and submit to the Consultant for review.

### **1.20 DEMONSTRATION OF COMPLETE SYSTEMS**

- .1 At the conclusion of the job, the Mechanical Trade Contractor shall review and demonstrate to the Owner all equipment and their respective functions and operation. Such demonstration shall be provided for such reasonable periods of time as the complexity of the job warrants, and as approved by the Consultant. Such review and demonstration shall be made by an authorized representative of the Mechanical Trade Contractor, fully knowledgeable of the project, it's installation and operation.
- .2 Provide the Consultant with a schedule of system demonstration at least 2 weeks prior to demonstration.

### **1.21 MANUFACTURERS REVIEW**

- .1 It shall be the responsibility of the Mechanical Contractor to have the equipment supplier or his representative to review all proposed connections, clearances, sizes, valves, breakers, etc. including wire and pipe sizes to his equipment before installation commences. At that time, he shall inform the Consultant of any changes required to make the equipment function satisfactorily.
- .2 Provide the Mechanical Trade Contractor with a letter accepting all connections as proposed and where required recommend necessary changes.
- .3 If any changes or additional material and labour are required to make the equipment function properly to capacity and the manufacturer has not pointed out this work prior to commencement of work, the additional and/or corrective work shall then be done at the expense of the equipment supplier.

**END OF SPECIFICATION SECTION**

**APPENDIX A**

**SHOP DRAWING SUBMITTAL FORM**

General Contractor: \_\_\_\_\_

Phone Number: \_\_\_\_\_ Fax No. \_\_\_\_\_

Mechanical Contractor: \_\_\_\_\_

Phone Number: \_\_\_\_\_ Fax No. \_\_\_\_\_

Mechanical Contractor Project Representative: \_\_\_\_\_

Item: \_\_\_\_\_

Number of Copies: \_\_\_\_\_

Supplier: \_\_\_\_\_

Manufacture: \_\_\_\_\_

Specification Section and Item: \_\_\_\_\_

Drawing Reference: \_\_\_\_\_

Specified Options Indicated  Yes  No

Items are in Conformance with Plans and Specifications Confirmed by Contractor.  
 Yes  No

If No, explain: \_\_\_\_\_

Contractors Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Part 1 General**

**1.1 GENERAL**

- .1 All conditions included in Section 21 05 05, Division 1 and General Conditions form part of this Specification and the Contractor shall comply with all and each clause included in these Sections.

**1.2 RELATED REQUIREMENTS**

- .1 Section 21 05 05 – Common Work Results for Fire Protection Systems.

**1.3 REFERENCE STANDARDS**

- .1 Authority Having Jurisdiction
  - .1 Conform to the requirements of the Authority Having Jurisdiction.
- .2 National Fire Prevention Association (NFPA)
  - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.
  - .3 NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

**1.4 SUBMITTALS**

- .1 Provide Shop Drawing and Maintenance Manual submittals in accordance with Section 01 33 00 – Submittal Procedures and Sections 21 05 00 – Common Work Results for Fire Protection.
- .2 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of content, and total cost of materials for project.
  - .3 Regional Materials: submit evidence that project incorporates required percentage 50% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit Operation and Maintenance Data: submit operation and maintenance data for system.



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

- .1 Deliver, store and handle materials in accordance with Section 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.

## **Part 2 Products**

### **2.1 SYSTEM REQUIREMENTS**

- .1 Provide automatic dry pipe fire suppression sprinkler systems in accordance with plans, specifications, NFPA 13, and requirements of the Authority Having Jurisdiction.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 Each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed Shop Drawings.
- .4 Locate sprinkler heads in consistent pattern as shown on plans. Avoid conflict with ceiling mounted equipment including, but not limited to ceiling grid, lights, diffusers, grilles, chilled beams, and speakers.
- .5 Devices and equipment to be ULC approved for use in dry pipe sprinkler systems.

### **2.2 ABOVE GROUND PIPING SYSTEMS**

- .1 Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Conceal piping in areas with suspended ceiling and where shown.
- .3 Identify piping as per Section 23 05 54 – Mechanical Identification.

### **2.3 PIPE, FITTINGS AND VALVES**

- .1 Above Ground Pipe: to be galvanized
  - .1 Ferrous: to NFPA 13.
    - .1 For sizes up to 1.1/4" threaded Sch 40.
    - .2 For sizes 1.1/2" and larger Sch 10 roll grooved.
  - .2 Above Ground Fittings and Joints Pipe to NFPA 13:
  - .3 Ferrous: class 150 screwed, welded, flanged, or roll grooved.
  - .4 Bolts: Square or hex head to ASTM A307.
  - .5 Flange Gasket: 1/16" thick cloth inserted red rubber.
  - .6 Grooved Products:
    - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity, visual pad-to-pad offset contact, and ULC listed for use in a Dry System.

- .2 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted.
- .3 Grooved couplings to be complete with angle bolt pads to provide a rigid joint, equal to Victaulic Style 009 Firelock, or Gruvlok 7400.
- .4 Grooved products provided for this work and work covered under related sections to be provided by only one manufacturer.
- .5 Fittings to ASTM A47-99 and A536-84.
- .6 Roll grooved coupling gaskets shall be EPDM and rated for a minimum temperature of 121°C.
- .7 Acceptable Manufacturers: Victaulic, Gruvlok, Shurjoint
- .7 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
- .8 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
- .9 Fittings: ULC approved for use in dry pipe sprinkler systems.
- .10 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
- .2 Valves:
  - .1 ULC listed for fire protection service.
  - .2 Gate valves: open by counterclockwise rotation.
  - .3 Provide indicating valves as shown on system schematic in each riser.
  - .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 4" and larger.
  - .5 All valves controlling water supply to be c/w supervisory switches.
  - .6 Provide supervised shut off valves in piping protecting elevator hoist ways, machine rooms, machinery spaces, and other spaces shown on plans and as required by NFPA 13. Where located in 'finished' spaces locate in recessed valve boxes.
- .3 Pipe hangers to be ULC listed for fire protection services in accordance with NFPA.

## 2.4 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type: material, finish, orientation, orifice size, k value, required protection, and temperature rating shown on Drawings.
- .3 All sprinkler heads shall have a brass finish unless shown otherwise.
- .4 Sprinklers shall be Quick Response.

## 2.5 DRY SYSTEM ALARM VALVE

- .1 Alarm check valve to NFPA 13 and ULC listed for fire service.
- .2 Provide variable pressure type alarm valve c/w accelerator, alarm test valve, indicating shutoff valve, test valve, drain valve, pressure gauges, alarm pressure

or flow switch (with supervisory capabilities), accessories, and appurtenances for proper operation of system.

- .3 Provide valve c/w internal components that are replaceable without removing the valve from the installed position.
- .4 Valve to be electronically supervised by the Fire Alarm System.

## **2.6 SUPERVISORY SWITCHES**

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves:
  - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Pressure switch type:
  - .1 With normally open and normally closed contacts and supervisory capability.
  - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
  - .3 Connect into building fire alarm system.
  - .4 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
  - .5 Acceptable Manufacturers: Potter, System Sensor.

## **2.7 COMPRESSED AIR SUPPLY**

- .1 Provide ULC listed air compressor with the capacity to restore normal air pressure in the system in 30 minutes or less.
- .2 'Normal' Pressure is 20 psi above trip pressure.
- .3 Piping to be ¾" c/w screwed joints and fittings.

## **2.8 PRESSURE GAUGES**

- .1 Maximum limit of not less than twice normal working pressure at point where installed.
- .2 Install pressure gauge with drag pointer to record peak water pressures downstream of water entrance.

## **2.9 PIPE SLEEVES**

- .1 Provide pipe sleeves as per section 21 05 05 – Common Work Results – Fire Protection.

## **2.10 ESCUTCHEON PLATES**

- .1 Provide one piece, split hinge type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
- .2 Provide polished stainless steel plates in washrooms, shower rooms, Locker Rooms, and other areas noted on Drawings. In all other areas chromium-plated finish on copper alloy plates are acceptable in finished spaces.

- .3 Provide paint finish on metal plates in unfinished spaces.

## **2.11 INSPECTOR'S TEST CONNECTION**

- .1 Locate inspector's test connection at hydraulically most remote part of each zone and as shown on the Drawings.
- .2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

## **2.12 SIGNS**

- .1 Attach properly lettered English metal signs to each valve and alarm device to NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

## **2.13 SPARE PARTS CABINET**

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

## **2.14 ACCESS DOORS**

- .1 Where components requiring service (e.g., drain valves, pressure switches) are located above finished ceilings or finished walls supply access doors for installation by others.
- .1 Sizes: as follows :
  - .1 For body entry: 600 x 600 mm minimum.
  - .2 For hand entry: 300 x 300 mm minimum.
- .2 Construction: rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees.

## **2.15 AUXILIARY DRAINS**

- .1 Install where shown and at low points in system. See detail on Drawing.
- .2 Pre-manufactured units are acceptable.
  - .1 Acceptable Materials: AGF Manufacturing Inc., Collect and Drain.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written recommendations or Specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

### **3.2 INSTALLATION**

- .1 Install inspect and test to acceptance in accordance with NFPA 13 and NFPA 25 and requirements of the AHJ.
- .2 Provide gate, check, and ball valves necessary to complete the system and as shown on the Drawings. Install horizontal valves with handles vertically on top (where space permits).
- .3 Arrange drains as indicated or as required so that all parts of the system can be drained. Install drum drip drains (see detail) where drains are located in areas subject to freezing.
- .4 Provide sprinklers with extended escutcheons where necessary to clear obstructions below finished ceiling and where shown.
- .5 Co-ordinate locations of all holes required for pipes with the work of other trades and provide pipe sleeves where pipes pass through walls and floors. Pack voids between pipes and sleeves with fibreglass and between pipes and existing walls and floors. Piping may be grouted solid at walls, without the use of sleeves. Installation of sleeves by General Contractor. Provide fire stopping where pipes penetrate fire walls or floors.
- .6 Access Doors
  - .1 Arrange location of equipment requiring access so that use of access doors is minimized.
  - .2 Where equipment requiring the installation of an access door(s) for access is to be located in places other than shown on the Drawing obtain the permission of the Consultant or Architect before proceeding with installation.
- .7 Shield sprinkler heads with protective covering while painting and other dirty work is in progress. Upon completion of painting/dirty work, remove protective covering from sprinkler heads. Replace sprinkler heads which have been painted or cannot be cleaned.
- .8 Identify system components as per specification Section 23 05 54 – Mechanical Identification and the requirements of the AHJ.
- .9 Install Spare Parts Cabinet.
- .10 At all times during construction protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system. Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .11 Clean installation.

### **3.3 PIPE INSTALLATION**

- .1 Install piping straight and true to bear evenly on hangers and supports. Support from building structure. Do not hang piping from plaster ceilings.
- .2 Beam clamps attached to OWSJ to be attached only at the Panel Points of the joist.

- .3 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .4 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .5 Inspect piping before placing into position.
- .6 All piping to run concealed except where noted on Drawings. All main lines to be kept as high and neat as possible. Pipe to run parallel to building lines unless noted otherwise. See notes on Drawings regarding piping in unfinished areas.
- .7 All branch piping connections to be from the top of the main, pendant sprinklers to be installed on return bends.
- .8 Install a ½" air vent c/w ball valve near the high point of each zone.

### **3.4 ELECTRICAL CONNECTIONS**

- .1 Electrical work associated with this section including wiring of supervisory switches provided by Fire Alarm Contractor and/or Electrical Contractor under Section 26 05 00 – Common Work Results for Electrical. Coordinate device location with these Contractors.
- .2 Calibrate flow switches and supervisory switches.

### **3.5 FIELD PAINTING**

- .1 Clean, pre-treat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Clean surfaces to remove dust, dirt, rust, and loose mill scale. Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Immediately after cleaning, provide metal surfaces with one coat of pre-treatment primer applied to minimum dry film thickness of 0.3 mil, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 mil.

### **3.6 FIELD QUALITY CONTROL**

- .1 Site Test, Inspection:
  - .1 Perform test to determine compliance with specified requirements in presence of Consultant.
  - .2 Test, inspect, and approve piping before covering or concealing.
  - .3 Preliminary Tests:
    - .1 Hydrostatically test to NFPA 13.
    - .2 Flush piping with potable water in accordance with NFPA 13.
    - .3 Piping above suspended ceilings: tested, inspected, and reviewed by Consultant before installation of ceilings.
  - .4 Formal Tests and Inspections:
    - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

- .2 Submit written request for formal inspection at least 15 days prior to inspection date.
- .3 Repeat required tests as directed.
- .4 Correct defects and make additional tests until systems comply with Contract requirements.
- .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
- .6 Authority of Jurisdiction will witness formal tests and approve systems before they are accepted.

**END OF SECTION**

## **Part 1        General**

### **1.1        SUMMARY**

- .1        This Section includes requirements for selective demolition and removal of plumbing and related mechanical components and incidentals required to complete Work described in ready for new construction.

### **1.2        REFERENCE STANDARDS**

- .1        CSA Group (CSA)
  - .1        CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

### **1.3        DEFINITIONS**

- .1        Demolish: Detach items from existing construction and legally dispose of items off-site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2        Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off-site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3        Remove and Salvage: Detach items from existing construction and deliver them to a third party ready for reuse.
- .4        Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5        Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6        Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

### **1.4        ADMINISTRATIVE REQUIREMENTS**

- .1        Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2        Scheduling: Account for City's continued occupancy requirements during selective demolition and schedule staged occupancy and work Site activities.



## **1.5 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Perform work of this Section in accordance with the following:
  - .1 Northwest Territories Workers' Safety and Compensation Commission.
  - .2 Northwest Territories Occupational Health and Safety Regulations.

## **1.6 SITE CONDITIONS**

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.
- .2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work; immediately notify the Consultant if materials suspected of containing hazardous substances are encountered and perform the following activities:
  - .1 Hazardous substances will be as defined in the Hazardous Products Act.
  - .2 Stop work in the area of the suspected hazardous substances.
  - .3 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
  - .4 Hazardous substances will be removed under a separate contract or as a change to the Work.
  - .5 Proceed only after written instructions have been received from the Consultant.

## **1.7 SALVAGE AND DEBRIS MATERIALS**

- .1 Demolished items become Contractor 's property and will be removed from Project Site; except for items indicated as being reused, salvaged, or otherwise indicated to remain the City's property.
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of material.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 General Patching and Repair Materials: Gypsum Board Patching Compounds: Joint compound to ASTM C475/C475M, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board ready for new finishes.
- .2 Plumbing Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.

- .3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Existing Conditions: Visit Site, thoroughly examine and become familiar with conditions that may affect the Work of this Section before tendering the Bid; the Consultant will not consider claims for extras for Work or materials necessary for proper execution and completion of the contract that could have been determined by a Site visit.

#### **3.2 PREPARATION**

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
  - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
  - .2 Notify the Consultant and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
  - .3 Prevent debris from blocking drainage inlets.
  - .4 Protect plumbing systems that must remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the City and users is minimized and as follows:
  - .1 Prevent debris from endangering the safe access to and egress from occupied buildings.
  - .2 Prevent the operation of the Fire Hall.
  - .3 Notify the Consultant and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

#### **3.3 EXECUTION**

- .1 Demolition: Coordinate requirements of this Section with information as follows:
  - .1 Disconnect and cap water and sewer services in accordance with requirements of local Authority Having Jurisdiction.
  - .2 Ceilings: patch, repair, or re hang existing ceilings as necessary to provide an even plane surface of uniform appearance.
  - .3 Do not disrupt active or energized utilities without written authorization of the Consultant and the City.

- .4 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
- .5 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
- .6 At end of each day's work, leave work Site in safe condition.
- .7 Perform demolition work in a neat and workmanlike manner:
  - .1 Remove any tools or equipment after completion of work and leave Site clean and ready for subsequent renovation work.
  - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

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

**1.2 REFERENCE STANDARDS**

- .1 Canadian Gas Association (CGA)
  - .1 CSA/CGA B149.1- 20, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60- [97], Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3- [92], Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 13- 2022, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 14- 2019, Standard for the Installation of Standpipe and Hose Systems.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product data to include paint colour chips, other products specified in this Section.
- .2 Samples:
  - .1 Samples to include nameplates, labels, tags, lists of proposed legends.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

**Part 2 Products**

**2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

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

## 2.2 SYSTEM NAMEPLATES

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size # 5.
  - .2 Equipment in Mechanical Rooms: use size # 9.
- .5 Identification for Public Services and Procurement Canada (PSPC) Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.
    - .3 Terminal cabinets, control panels: size #5.
  - .3 Equipment elsewhere: sizes as appropriate.

## 2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this Section.

## 2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
  - .1 Natural gas: to CSA/CGA B149.1.
  - .2 Propane gas: to CSA/CGA B149.1.
  - .3 Sprinklers: to NFPA 13.
  - .4 Standpipe and hose systems: to NFPA 14.

## 2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Consultant.
  - .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
River water	Green	RIVER WATER
Sea water	Green	SEA WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	

<b>Contents</b>	<b>Background colour marking</b>	<b>Legend</b>
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO <sup>2</sup>
Instrument air	Green	INSTRUMENT AIR

## **2.6 IDENTIFICATION OF DUCTWORK SYSTEMS**

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

## **2.7 VALVES, CONTROLLERS**

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

## **2.8 CONTROLS COMPONENTS IDENTIFICATION**

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

## **2.9 LANGUAGE**

- .1 Identification in English.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

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



### **3.3 NAMEPLATES**

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

### **3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### **3.5 VALVES, CONTROLLERS**

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

**3.6 CLEANING**

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

**END OF SECTION**

**Part 1        General**

**1.1        SUMMARY**

- .1 Section Includes:
  - .1 General requirements that are common to NMS sections found in Division 26 – Electrical.

**1.2        REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  - .2 CAN3-C235-[83(R2000)], Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.3        DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English.

**1.4        SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Quality Control:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to Site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of Contract.
  - .5 Submit, upon completion of Work, load balance report as described in **Part 3 – Load Balance**.

- .6 Submit certificate of acceptance from Authority having Jurisdiction upon completion of Work to Consultant.
- .3 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in **Part 3 – Field Quality Control**.

## **1.5 QUALITY ASSURANCE**

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with Authorities having Jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

## **1.6 SYSTEM STARTUP**

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

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to Site and submit such approval as described in Part 1 – Submittals.
- .2 Factory assemble control panels and component assemblies.

### **2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 – Control Devices except for conduit, wiring and connections below 50 V which are related

to control systems specified in Mechanical Sections and as shown on Mechanical Drawings.

### 2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities.
- .2 Lamacoid signs, minimum size 175 by 250 mm.

### 2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

### 2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
  - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black with white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
  - .2 Sizes as follows:

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

- .2 Wording on nameplates to be approved Contract Administrator prior to manufacture.
- .3 Allow for minimum of 25 letters per nameplate.
- .4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .6 Terminal cabinets and pull boxes: indicate system and voltage.
- .7 Transformers: indicate capacity, primary and secondary voltages.

### 2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.

- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

**2.7 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

**2.8 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least 2 coats of finish enamel.
  - .1 Paint outdoor electrical equipment "equipment green" finish.
  - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

**3.2 NAMEPLATES AND LABELS**

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

**3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: schedule 40 steel pipe or plastic, sized for free passage of conduit, and protruding 50 mm.

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

### **3.4 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3,000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

### **3.5 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1,400 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1,400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Fire alarm stations: 1,500 mm.
  - .5 Fire alarm bells: 2,100 mm.

### **3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

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

### **3.7 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Provide upon completion of work, load balance report as directed in **Part 1 – Submittals**: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests:
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .4 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1,000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Consultant.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in **Part 1 – Submittals**.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic Site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule Site visits, to review Work, as directed in **Part 1 – Quality Assurance**.

### 3.8 CLEANING

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

**END OF SECTION**



## **Part 1        General**

### **1.1        SUMMARY**

- .1        This Section includes requirements for selective demolition and removal of electrical components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section.

### **1.2        REFERENCE STANDARDS**

- .1        Canadian Standards Association (CSA)
  - .1        CSA S350 M1980 [(R2003)], Code of Practice for Safety in Demolition of Structures.

### **1.3        DEFINITIONS**

- .1        Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2        Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3        Remove and Salvage: Detach items from existing construction and deliver them to the City of Winnipeg ready for reuse.
- .4        Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5        Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6        Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

### **1.4        ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Action Submittals: Provide in accordance with Section 01 33 00 – Submittal Procedures before starting work of this Section:
  - .1        Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## **1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Perform Work of this Section in accordance with:
  - .1 Manitoba Worker Compensation Boards, and the Workers' Compensation Board of Canada.
  - .2 Government of Canada, Labour Program: Workplace Safety.
  - .3 Manitoba Occupational Health and Safety Standards and Programs.

## **1.7 SITE CONDITIONS**

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.
- .2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify the Consultant if materials suspected of containing hazardous substances are encountered and perform following activities:
  - .1 Refer to Section 01 41 00 – Regulatory Requirements for directives associated with specific material types.
  - .2 Hazardous substances will be as defined in Hazardous Products Act.
  - .3 Stop work in area of suspected hazardous substances.
  - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
  - .5 Hazardous substances will be removed by City of Winnipeg under a separate contract or as a change to Work.
  - .6 Proceed only after written instructions have been received from the Owner's Representative.

## **Part 2 Products**

### **2.1 NOT USED REPAIR MATERIALS**

- .1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .2 Firestopping Repair Materials: Use firestopping materials compatible with existing firestopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

## **2.2 SALVAGE AND DEBRIS MATERIALS**

- .1 Material Ownership: Demolished materials become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, reinstalled, or otherwise indicated to remain City of Winnipeg's property.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Existing Conditions: Visit Site, thoroughly examine and become familiar with conditions that may affect work of this Section before tendering Bid; City of Winnipeg will not consider claims for extras for work or materials necessary for proper execution and completion of contract that could have been determined by a Site visit.

### **3.2 PREPARATION**

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
  - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
  - .2 Notify Consultant and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
  - .3 Prevent debris from blocking drainage inlets.
  - .4 Protect mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with use of the building by City of Winnipeg and users is minimized and as follows:
  - .1 Prevent debris from endangering safe access to and egress from occupied buildings.
  - .2 Notify Consultant and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

### **3.3 EXECUTION**

- .1 Removal and Demolition: Coordinate requirements as follows:
  - .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
  - .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.

- .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .4 Disconnect and remove communication systems including associated conduits, boxes, cabling, and similar items unless specifically noted otherwise.
- .5 Disconnect and remove telephone outlets, associated conduit, cabling and sub terminal backboards and related accessories; maintain telephone service and main terminal backboard as is.
- .6 Perform demolition work in a neat and workmanlike manner:
  - .1 Remove tools or equipment after completion of work and leave Site clean and ready for subsequent renovation work.
  - .2 Repair and restore damages caused because of work of this Section to match existing materials and finishes.
- .7 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as "SPARE".
- .8 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
- .9 Remove existing conduits, boxes, cabling, and wiring associated with removed luminaires, electrical devices and equipment.
- .10 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
- .11 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

### **3.4 CLOSEOUT ACTIVITIES**

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with all local code and by laws requirements.

**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. 83, Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
  - .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings
- .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .5 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1 m oc.
- .4 Galvanised steel threaded rods, 6 mm dia., to support suspended channels.

**2.3 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

## **2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

## **2.5 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 X-ray cast walls and floors before coring to confirm location of embedded items.
- .3 Use rigid threaded conduit in areas subject to mechanical injury.
- .4 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .6 Use rigid PVC conduit in cast concrete.
- .7 Use rigid PVC underground.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10<sup>th</sup> of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm dia.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Run 4-25 mm spare conduits up to ceiling space and 2 - 25 mm spare conduits down to ceiling space from each flush panel.
  - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.

- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### **3.3 CONCEALED CONDUITS**

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

### **3.4 CONDUITS IN CAST-IN-PLACE CONCRETE**

- .1 Locate to suit reinforcing steel.
  - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
  - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

**3.5 CONDUITS UNDERGROUND**

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

**END OF SECTION**