

**Part 1 General**

**1.1 DESCRIPTION**

- .1 Further to C12, this section specifies administrative and procedural requirements necessary to prepare and process applications for payment.

**1.2 LUMP SUM PRICES**

- .1 Description: Lump sum prices are an amount incorporated in the Contract for a specific product or portion of Work on a lump sum basis.
  - .1 Lump sum prices are identified on Form B – Prices where quantities of the prices are identified as 1 unit, and the unit of measure is identified as lump sum.
- .2 Requirements: Refer to General Conditions.
- .3 Measurement and Payment Procedures:
  - .1 Refer to C12.
  - .2 Payment for lump sum price components of the work will be measured as a percent of completion of the total lump sum value.
  - .3 Mobilization and Demobilization
    - .1 Mobilization and demobilization will be measured on a lump sum basis and paid for at the Contract Lump Sum Price for “Mobilization and Demobilization”. Payment for Mobilization and demobilization shall include all costs associated with mobilization and demobilization, site set up, and cleanup. Payment will be made on the following schedule:
    - .2 25% payment of the Mobilization and Demobilization lump sum price will be paid once the Contractor arrives on site and installs specified temporary utilities, construction facilities, temporary barriers and enclosures, temporary facility protection, and temporary controls in 2023.
    - .3 50% of the Mobilization and Demobilization lump sum price will be paid subsequent to completion of the Work, removal of specified temporary utilities, construction facilities, temporary barriers and enclosures, temporary facility protection, and temporary controls and site cleanup and restoration in 2023.
    - .4 75% payment of the Mobilization and Demobilization lump sum price will be paid once the Contractor arrives on site and installs specified temporary utilities, construction facilities, temporary barriers and enclosures, temporary facility protection, and temporary controls in 2024.
    - .5 1000% of the Mobilization and Demobilization lump sum price will be paid subsequent to completion of the Work, removal of specified temporary utilities, construction facilities, temporary barriers and enclosures, temporary facility protection, and temporary controls and site cleanup and restoration in 2024.

**1.3 UNIT PRICES**

- .1 Description: 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.
  - .1 Unit prices are identified on Form B – Prices where quantities of the prices are greater than 1 unit.
- .2 Requirements: Refer to General Conditions.
- .3 Measurement and Payment Procedures:

- .1 Unit prices are included in the total bid price as entered on Form B – Prices incorporating the estimated quantities provided.
- .2 Actual quantities will be identified by the Contract Administrator in the presence of and with the assistance of the Contractor. The quantity will be measured and agreed upon by the Contractor and Contract Administrator prior to submission of the progress estimate.
- .3 If the quantity is increased over that originally measured without consultation with the Contract Administrator, the Contractor will not be paid for the increased quantity.
- .4 Schedule of Unit Prices:
  - .1 Hollowcore grout joint repair:
    - .1 Repair to hollowcore grouted joints exhibiting extensive spalling and/or delamination by mechanical removal of the deteriorated concrete and infilling with a rapid-setting mortar.
    - .2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.
    - .3 Repair areas include Work specified in the following Sections, all of which are included in the unit price:
      - .1 Section 02 41 99 – Demolition for Minor Works.
      - .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.
      - .3 Section 03 92 12 – Hollowcore Grout Joint Repair.
    - .4 Unit of measure: per lineal metre.
      - .1 The minimum area of payment will be 0.3 metres.
  - .2 Concrete top surface scaling repairs:
    - .1 Removal and replacement of scaled surface areas the structural concrete deck.
    - .2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.
    - .3 Repair areas include Work specified in the following Sections, all of which are included in the unit price:
      - .1 Section 02 41 99 – Demolition for Minor Works.
      - .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.
      - .3 Section 03 92 20 – Scaling Repairs.
    - .4 Scaling repair – 0 mm to 25 mm deep:
      - .1 Removal and infill depths of up to 25 mm in depth.
        - .1 Unit of measure: per square metre.
        - .2 The minimum area of payment will be one square metre.
  - .3 Epoxy crack repair:
    - .1 Repair of cracks in concrete by placing epoxy into routed cracks
    - .2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

- .3 Repair areas include Work specified in the following Sections, all of which are included in the unit price:
  - .1 Section 03 95 11 – Epoxy Crack Repair.
- .4 Unit of measure: per lineal meter (lin. m.).
  - .1 The minimum area of payment will be 0.3 lin. m.
- .4 Pre-cast concrete weld plate repair:
  - .1 Removal and replacement of concrete exhibiting extensive spalling and/or delamination at pre-cast concrete panel weld plates.
  - .2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.
  - .3 Repair areas include Work specified in the following Sections, all of which are included in the unit price:
    - .1 Section 02 41 99 – Demolition for Minor Works.
    - .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.
    - .3 Section 03 93 30 – Pre-cast Concrete Weld Plate and Flange Edge Repair.
    - .4 Section 03 95 11 – Epoxy Crack Repair.
  - .4 Unit of measure: per location.
    - .1 Each location includes the length of the weld plate and dimensions show on Drawings.
    - .2 The minimum area of payment will be one location.
- .5 Pre-cast concrete flange edge repair:
  - .1 Removal and replacement of concrete exhibiting extensive spalling and/or delamination at pre-cast concrete flange edges.
  - .2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.
  - .3 Repair areas include Work specified in the following Sections, all of which are included in the unit price:
    - .1 Section 02 41 99 – Demolition for Minor Works.
    - .2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.
    - .3 Section 03 93 30 – Pre-cast Concrete Weld Plate and Flange Edge Repair.
    - .4 Section 03 95 1 – Epoxy Crack Repair.
  - .4 Unit of measure: per lineal metre.
    - .1 The minimum area of payment will be 0.3 lineal metres.
- .6 Concrete testing: Mortar Cubes.
  - .1 Inspection and testing of concrete repair mortar.
  - .2 Testing requirements and frequency specified in the following Sections, all of which are included in the unit price:
    - .1 Section 03 92 12 – Hollowcore Grout Joint Repair.
    - .2 Section 03 92 20 – Scaling Repairs.
    - .3 Section 03 93 30 – Pre-cast Concrete Weld Plate and Flange Edge Repair.

- .3 Submit test samples to a CSA certified testing laboratory in accordance with ASTM C109.
- .4 Submit laboratory reports to Contract Administrator.
- .5 Unit of measure: per test cube.
  - .1 Minimum payment for testing: 1 cube.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies administrative and procedural requirements for meetings.

**1.2 PRE-CONSTRUCTION MEETING**

- .1 Promptly after Contract award, the Contract Administrator will establish the time and location of a pre-construction meeting to review and discuss administrative procedures and responsibilities. Contract Administrator will notify Contractor at least seven (7) Calendar Days before the meeting.
- .2 The Contractor shall arrange for the following senior representatives to be in attendance:
  - .1 Contractor's project manager and site superintendent.
  - .2 Major Subcontractors.
- .3 Contract Administrator will chair the conference and record and distribute the minutes.
- .4 Agenda:
  - .1 Introductions
  - .2 Communications
  - .3 Award of Contract
  - .4 Scope of Work
  - .5 Subcontractors
  - .6 Commencement
  - .7 Schedule
  - .8 Construction Sequence
  - .9 Utilities
  - .10 Project Issues
  - .11 Site Meetings
  - .12 Status Meetings
  - .13 Safety
  - .14 Security
  - .15 Environmental
  - .16 Regulatory
  - .17 Mock-ups
  - .18 Other

**1.3 CONSTRUCTION PROGRESS MEETINGS**

- .1 In accordance with Section D supplemented with the following:
  - .1 Progress meetings to be scheduled every two weeks.
  - .2 Contract Administrator will chair the meetings, and record and distribute the minutes.
  - .3 The Contractor shall provide physical space and make arrangements for meetings.
  - .4 The Contractor shall ensure that Subcontractors attend when it is appropriate to the discussion of the progress of the Work.
  - .5 Agenda:
    - .1 Review of last meeting minutes and action items,
    - .2 Schedule,

- .3 Progress status,
- .4 Construction issues,
- .5 Utilities,
- .6 Project risks,
- .7 Environment,
- .8 Safety,
- .9 Submittals,
- .10 Work by others,
- .11 Change control,
- .12 Request for Information (RFI) log,
- .13 Site security,
- .14 Quality Control (QC) and Quality Assurance (QA),
- .15 Other Business, and
- .16 Date of Next Meeting.

**1.4 PRE-INSTALLATION CONFERENCE**

- .1 Convene a pre-installation conference a minimum of one (1) week prior to beginning on site installation of Work or mock-up as required in individual technical sections.
- .2 Establish date, time and location of conference and notify parties concerned a minimum of seven (7) Calendar days before pre-installation conference.
- .3 Contractor and any Subcontractors and manufacturer's representatives involved in work and Contract Administrator to be in attendance.
- .4 The Contract Administrator will be responsible for recording minutes and circulating to the attending parties and affected parties not in attendance within seven (7) Calendar days after conference.
- .5 Agenda for conference:
  - .1 Verify project requirements, design and intent of design,
  - .2 Review installation and substrate conditions,
  - .3 Co-ordination with subtrades,
  - .4 Review Manufacturer's installation instructions and warranty requirements,
  - .5 Review compatibility of materials, and
  - .6 Review testing requirements.
  - .7 Review of facility protection.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This Section specifies Contractor's responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.
- .2 The purpose of submitting progress schedules is to:
  - .1 Inform the City and Contract Administrator of actual progress versus planned progress, and
  - .2 Provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

**1.2 SUBMITTALS**

- .1 Construction Schedule:
  - .1 Submit detailed work schedule in accordance with Section D.
- .2 Submittals Schedule:
  - .1 Submit via e-mail in electronic PDF format.
  - .2 Submit initial schedule to Contract Administrator within twenty-one (21) Calendar Days after Contract award.
  - .3 Submit to Contract Administrator as a submission to the Contract Administrator in accordance with Section 01 33 00 Submittal Procedures.
- .3 Progress Photographs:
  - .1 Submit photographs in electronic version via the Contract Administrator's SharePoint site as a submission to the Contract Administrator in accordance with Section 01 33 00 Submittal Procedures.
  - .2 Pre-Construction: Submit prior to mobilizing on site.
  - .3 Construction Progress:
    - .1 Submit monthly.
    - .2 Submit upon completion of key milestone activities as requested by the Contract Administrator.

**1.3 DETAILED WORK SCHEDULE**

- .1 In accordance with Section D.

**1.4 SUBMITTALS SCHEDULE**

- .1 Format and Content:
  - .1 Prepare a tabulated schedule identifying all required items for material procurement:
    - .1 Shop drawings.
    - .2 Product data.
    - .3 Sample submissions.
      - .1 Including:
        - .1 Samples required for testing.
  - .2 Prepare schedule in electronic format.
  - .3 Provide a separate line for each required submittal, organized by Specifications section name and number, and further broken down by individual Products and systems as required.

- .4 For each required submittal, show:
  - .1 Planned earliest date for initial submittal.
  - .2 Earliest date for return of reviewed submittal by the Contract Administrator.
  - .3 Latest date for return of reviewed submittal without causing delay.
- .5 Allow time in schedule for resubmission of submittals, should resubmission be necessary.
- .2 Contract Administrator Review:
  - .1 The Contract Administrator will review the format and content of the initial schedule and request necessary changes, if any, within fourteen (14) Calendar Days after receipt.
  - .2 If changes are required, resubmit finalized schedule within seven (7) Calendar Days after return of the Contract Administrator reviewed copy.
  - .3 Submit updated submittals schedule monthly to the Contract Administrator.

## **1.5 SCHEDULE MANAGEMENT**

- .1 A schedule submitted as specified and accepted by the City and Contract Administrator shall become the baseline schedule and shall be used as the baseline for updates.
- .2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with Contract Administrator and the City, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.
- .3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

## **1.6 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS**

- .1 Print a hard copy set of construction Drawings and Specifications for the purpose of creating as-built Drawings and Specifications. Record information in red ink on the hard copies, clearly identifying as-built deviations from the originally obtained construction Drawings and Specifications.
- .2 Clearly label each drawing as "AS-BUILT DRAWING". Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Record actual construction including:
  - .1 Field changes of dimension and detail.
  - .2 Changes made by Change of Work Orders and Field Instructions. Reference Change of Work Order and Field Instruction number.
  - .3 Clarifications made in Requests for Information (RFI). Reference RFI number.
  - .4 References to Shop Drawings, where Shop Drawings show more detail.
- .4 Do not use as-built drawings for construction purposes.

## **1.7 PROGRESS PHOTOGRAPHS**

- .1 Conduct a pre-construction inspection of the WTP existing conditions in the presence of the Contract Administrator to document existing conditions using digital photography. Pre-construction photographs will be used to evaluate pre-existing damage to finishes and responsibility of repair.
- .2 Arrange for periodic digital photography to document and provide a photographic record of the progress of the Work.
  - .1 At minimum, photographic record to include the following:
    - .1 Pre-demolition.



- .2 Substrate conditions following demolition.
- .3 Construction sequencing.
- .4 Final installation.
- .3 Identify each photograph by project name and date taken.
- .4 Do not use progress or any other project photographs for promotional purposes without the City's written consent.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                DESCRIPTION**

- .1        This section specifies administrative and procedural requirements for submittals.

**1.2                ADMINISTRATIVE**

- .1        Submit specified submittals to Contract Administrator 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        Review submittals, provide verified field measurements where applicable, and affix Contractor's review stamp prior to submission to the Contract Administrator. The 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.
- .6        Verify field measurements and that affected adjacent work is coordinated.
- .7        Submittals not meeting specified requirements will be returned with comments.
- .8        Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted.
- .9        Do not propose substitutions or deviations from the Contract Documents via Shop Drawing, product data and sample submittals.

**1.3                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, and
  - .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, and
- .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, and
  - .10 Relationships to other parts of the Work.
- .6 Contract Administrator's review stamp: Allow sufficient space on each sheet of shop drawings for Contract Administrator's comments and review stamp without requiring the stamp to overwrite text of the Shop Drawing.
- .5 Product data submittals shall include safety data sheets (SDS) for all controlled products.
- .6 Submit Shop Drawings where specified in the technical Specifications in electronic PDF format.
- .7 Submit product data sheets or brochures where specified in the technical Specifications in electronic 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 fourteen (14) Calendar Days for Contract Administrator's review of each submittal and incorporate in submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.
  - .1 Allow additional seven (7) Calendar Days for mechanical and plumbing shop drawing reviews.
- .11 If upon Contract Administrator'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 Contract Administrator'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 Contract Administrator's notations on submittals are intended to ensure compliance with the Contract Documents and are not intended to constitute a change in the Work requiring a change to the Contract Price or Contract Time. If the Contractor considers any Contract Administrator's notation to be a change in the Work, promptly notify the Contract Administrator 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 the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

**1.4 SAMPLES**

- .1 Submit single copy of samples for the Contract Administrator's review where specified in the technical Specifications. Label samples as to origin, Project name, and intended use.
- .2 Deliver samples prepaid to Contract Administrator's business address.
- .3 Notify Contract Administrator in writing of any deviations in samples from requirements of Contract Documents.
- .4 Where a required colour, pattern or texture has not been specified, submit a full range of available products.
- .5 The Contract Administrator's selection from samples is not intended to change the Contract Price or Contract Time. If a selection would affect the Contract Price or Contract Time, notify the Contract Administrator in writing immediately and prior to proceeding with the Work.
- .6 Resubmit samples as required by Contract Administrator to comply with Contract Documents.
- .7 Reviewed and accepted samples will establish the standard against which installed Work will be reviewed.

**1.5 HEALTH AND SAFETY SUBMITTALS.**

- .1 In accordance with Section 01 35 29 – Safety Procedures.

**1.6 SUBMISSIONS TO CONTRACT ADMINISTRATOR:**

- .1 Electronic versions via e-mail to:
  - .1 Contract Administrator in accordance with Section D.
  - .2 Contract Administration: [contractadmin@ckpeng.com](mailto:contractadmin@ckpeng.com).
- .2 Electronic versions via Contract Administrator's SharePoint site:
  - .1 Submit request to upload electronic submittals via Contract Administrator's SharePoint site via e-mail to:
    - .1 Contract Administrator in accordance with Section D.
    - .2 Contract Administration: [contractadmin@ckpeng.com](mailto:contractadmin@ckpeng.com).
  - .2 Contract Administrator will provide an e-mail invitation and link to upload files to SharePoint site.
- .3 Samples and hard copy versions to:
  - .1 Contract Administrator in accordance with Section D.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

## **Part 1            General**

### **1.1                REFERENCE STANDARDS**

- .1        Province of Manitoba
  - .1        The Workplace Safety and Health Act, Chapter W210 10/02 and associated regulations.
  - .2        Manitoba Workplace Safety and Health Regulation 217/2006.
  - .3        The Workers Compensation Act C.C.S.M c. W200.

### **1.2                SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2        Submit, by presentation to the Contract Administrator, the safety orientation for all Contractor's Personnel. This presentation must be made before commencement of the Work.
- .3        Submit to the Contract Administrator one (1) copy of any Safety Data Sheet (SDS) as required. These sheets must be submitted before the controlled product is used on Site.
- .4        Submit to the Contract Administrator:
  - .1        A safe work plan in accordance with Section D,
  - .2        Minutes of the weekly (toolbox) safety meetings,
  - .3        Accident investigations (if applicable),
  - .4        Site safety inspections, and
  - .5        Training records as appropriate.

### **1.3                SAFETY ASSESSMENT**

- .1        Perform site specific safety hazard assessment related to project.
- .2        Safety assessment to form basis of safe work procedures and site specific site safety plan.

### **1.4                MEETINGS**

- .1        Schedule, administer and record minutes for:
  - .1        Safety meetings,
  - .2        Weekly safety (toolbox) meetings.
- .2        Schedule meetings at minimum frequency required under legislation.
- .3        Discuss health and safety issues at each progress meeting in accordance with Section 01 31 19 – Project Meetings.

### **1.5                PROJECT/SITE CONDITIONS**

- .1        Hazardous Materials:
  - .1        Hazardous materials form part of water treatment processes.
  - .2        Certain areas are hazardous to open flame, sparks, or unventilated occupancy.
  - .3        Take measures to ensure that personnel observe proper safety precautions when working in these areas.
- .2        Ozone Generation Areas:
  - .1        The City uses ozone as part of the drinking water treatment process. This is denoted as area 'WO' in the Drawings.

- .2 Portions of this Contract involve work in the vicinity of the ozone generating equipment and the associated exhaust system on the roof. The exhaust system is connected to a catalytic ozone-destruct unit, however low concentrations of ozone may still be exhausted to the roof.
- .3 The Contractor shall be aware of the dangers of ozone exposure and take necessary precautions. The indoor ozone areas of the plant are outfitted with ozone detectors and alarms in the event of an ozone leak. The roof is not monitored for ozone exposure.
- .4 The City will provide ozone (O<sub>3</sub>) monitors for Contractor personnel working within five (5) meters of the ozone destruct unit exhaust ventilation on the roof.

## **1.6 GENERAL SITE RULES**

- .1 Follow all posted traffic control signs. The maximum speed on Site for all vehicles is 40 km/hr except as otherwise posted.
- .2 Ensure that all workers comply with "NO SMOKING" regulations in effect in areas of the Site.
- .3 Wear hard hats and safety footwear on the Site at all times. Wear reflective vests as required by Site policy.
- .4 Wear eye protection where there is a risk of eye injury; this includes chipping, grinding, welding, drilling, sawing, concrete placing, etc.
- .5 Wear hearing protection device where required and ensure all workers have a valid hearing test.
- .6 Use scaffolding that complies with regulations.
- .7 Obtain a valid certificate of inspection for all cranes and boom trucks before coming on Site.
- .8 Immediately remove any worker found to be impaired.
- .9 Immediately report all hazardous situations to the Contract Administrator.
- .10 Obtain and display at the Site SDS for all controlled products before the product is allowed on Site.

## **1.7 FIRST AID FACILITIES AND SERVICES**

- .11 The Contractor shall provide first aid services at the Site, including their Subcontractors, until Substantial Performance is achieved. Provide qualified first aiders to man the first aid facilities.
- .12 Provide first aid coverage for the Site at all times, including periods outside of normal work hours (evenings, weekends, and holidays) as required to support the work of Subcontractors. Coordinate with others to establish required durations and levels of first aid to support regular and non-regular work hours.
- .13 Make all provisions and pay all installation, manpower, equipment, medical supplies, restocking and other costs for the first aid facilities in order to provide ongoing service for the Site in accordance with the requirements of this Specification.
- .14 Locate the first aid facility in a convenient location within the Site. The Contractor shall provide and maintain unobstructed emergency vehicle access to the main door of the first aid facility, including appropriate signage as required.
- .15 Arrange and supply transportation for injured workers both on and off Site.
- .16 The Contract Administrator will review the Contractor's first aid facility, personnel, procedures, and safety and health program. The Contract Administrator is to have full access to the Work and the Contractor's first aid facilities and records at all times.

## **1.8 GENERAL REQUIREMENTS**

- .1 Develop written site-specific safe work plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. The safe work plan must address project specifications.
- .2 Keep copy of the relevant construction occupational safety and health regulations on Site at all times. Post the policies and notices for the information of workers.
- .3 Ensure that workers are instructed and trained in safe and healthy working practices; take immediate action to correct any unsafe conditions and hold regular weekly safety (toolbox) meetings with all workers.
- .4 Establish Job Safety and Health Procedures and provide copies for the Contract Administrator's information.
- .5 Attend a site safety orientation conducted by WTP.
- .6 Provide Safety Orientation for all Contractor Personnel.
  - .1 All Contractor Personnel must attend a Safety Orientation before access to the Site is granted.
- .7 Ensure that the following essentials of the Workplace Hazardous Materials Information System are provided:
  - .1 Worker education on controlled Products.
  - .2 Workplace labelling and identification.
  - .3 Safety Data Sheets (SDS).
- .8 Conduct formal safety inspections of Site. Inspections to be performed by one person from management and one person representing workers.

## **1.9 RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **1.10 COMPLIANCE REQUIREMENTS**

- .1 Comply with The Workers Compensation Act, Workplace Safety and Health Act Chapter W210 and Manitoba Workplace Safety and Health Regulation 217/2006.

## **1.11 UNFORSEEN HAZARDS**

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for an employee's right to refuse work in accordance with Acts and Regulations of Province/Territory having jurisdiction and advise the Contract Administrator verbally and in writing.

## **1.12 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by:
  - .1 The City, and
  - .2 The Contract Administrator.
- .2 Provide the following with written report of action taken to correct non-compliance of health and safety issues identified:

- .1 The City, and
- .2 The Contract Administrator.
- .3 If non-compliance of health and safety regulations is not corrected, the following may issue a stop Work order until the non-compliance is corrected:
  - .1 The City, and
  - .2 The Contract Administrator.

**1.13 WORK STOPPAGE**

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**



**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies administrative and procedural requirements for quality.
- .2 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.
- .3 Having inspection and testing agencies by the Contractor or the City does not relieve the Contractor of their responsibility to perform Work in accordance with the 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 the 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 Contract Administrator 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 the Contract Administrator, 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, and
  - .6 Indicate number of each test and inspection required.
- .3 Test Samples: Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.
- .4 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 the Contract Administrator.
  - .1 Submit within seven Calendar 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.
- .5 Certificates:
  - .1 Submit Product certificates as requested.

#### 1.4 QUALIFICATIONS

- .1 Contractor Qualifications: Contractors shall meet the following qualifications:
  - .1 Engaged full time with knowledge and experience in the risks, environmental impacts, and all components of the line of work required by these Contract Documents.
  - .2 Demonstrated experience satisfactory to the City and Contract Administrator:
    - .1 Prime Contractor:
      - .1 Minimum of:
        - .1 Five (5) projects over past five (5) years as Prime Contractor as follows:
          - .1 Successful completion of projects of similar value as that required by these Contract Documents, and
          - .2 Successful completion of projects of similar nature, scope and complexity as that required by these Contract Documents.
        - .2 Proposed project manager:
          - .1 Minimum of:
            - .1 Five (5) projects over past five (5) years as project manager as follows:
              - .1 Successful completion of projects of similar value as that required by these Contract Documents, and
              - .2 Successful completion of projects of similar nature, scope and complexity as that required by these Contract Documents.
            - .2 Proposed superintendent:
              - .1 Minimum of:
                - .1 Five (5) projects over past five (5) years as superintendent as follows:
                  - .1 Successful completion of projects of similar value as that required by these Contract Documents, and
                  - .2 Successful completion of projects of similar nature, scope and complexity as that required by these Contract Documents.
  - .2 Subcontractor Qualifications: Sub-contractors shall meet the following qualifications
    - .1 Engaged full time with knowledge and experience in the risks, environmental impacts, and all components of the line of work required by these Contract Documents.
    - .2 As specified in technical sections.
    - .3 Installer qualifications: In accordance with Installer Qualifications of this Section.
  - .3 Manufacturers' Qualifications:

- .1 Specializes in manufacturing the products specified in the technical sections of the Contract Documents.
- .2 Successful record of performance with minimum of:
  - .1 Ten (10) years of documented experience.
- .4 Suppliers' qualifications: Suppliers shall meet the following qualifications:
  - .1 Authorized to distribute manufacturer's products.
  - .2 Has capacity to supply required products without delaying the project.
- .5 Fabricator's Qualifications: Fabricators shall meet the following qualifications:
  - .1 Experienced in producing products required by the Contract Documents.
  - .2 Successful record of in-service performance.
  - .3 Sufficient capacity to fabricate required products without delaying the Project.
- .6 Installer Qualifications: Installers shall meet the following qualifications:
  - .1 Individual experienced in design and installation, application, and erection of materials to the extent required for this Project.
    - .1 Minimum of:
      - .1 Five (5) projects over past five (5) years.
  - .2 Successful record of in-service performance.
- .7 Licenced Professionals Qualifications:
  - .1 Individual registered or licenced to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the Province of Manitoba.

## **1.5 INDEPENDENT INSPECTION AND TESTING AGENCIES**

- .1 Except as otherwise specified, the City 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 the inspection and testing agencies by the Contractor or the City does not relieve the Contractor from the responsibility to perform the Work in accordance with the 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 Contract Administrator 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 test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.
- .8 Provide labour, equipment and temporary facilities to obtain and handle test samples on Site.
  - .1 Provide sufficient space to store and cure test samples.
- .9 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and

irregularities as advised by the Contract Administrator at no cost to the City. Pay costs for retesting and reinspection.

## **1.6 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.

## **1.7 TESTS**

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

## **1.8 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 the 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 will 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 Technical Specification sections specify whether mock-up may remain as part of Work or if it is to be removed and when.
- .8 Prepare mock-ups for the Contract Administrator's review with reasonable promptness and in orderly sequence, as to not cause delays in the Work.
- .9 Failure to prepare the mock-ups in ample time is not considered a sufficient reason for an extension of the Contract Time and no claim for extension by reason of such default will be allowed.

## **Part 2 Products**

### **2.1 NOT USED**

## **Part 3 Execution**

### **3.1 NOT USED**

**END OF SECTION**

**Part 1 General**

**1.1 TEMPORARY UTILITIES - GENERAL**

- .1 Provide temporary utilities as specified and as otherwise necessary to perform the Work expeditiously.
- .2 Remove temporary utilities after use.

**1.2 TEMPORARY WATER SUPPLY**

- .1 Connect to and use the City's existing water supply for temporary use during construction, subject to existing available volume and pressure.
  - .1 Usage at no cost to Contractor.
- .2 Arrange and pay for necessary water supply connections and disconnections.
- .3 Provide hoses, lines, connections, and other ancillary hardware required.
- .4 Return services to their original condition at the temporary locations, or left in an altered condition only as approved by the City.

**1.3 TEMPORARY HEATING AND VENTILATION**

- .1 Arrange and pay for temporary heating and ventilation required during construction.
- .2 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .3 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.
- .4 Provide temporary heat for the Work as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect the Work against dampness and cold.
  - .3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored Products.
  - .4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of Products.
- .5 Provide temporary ventilation for the Work as required to:
  - .1 Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.
  - .2 Ensure that hazardous, noxious, or volatile substances do not migrate to the City's occupied spaces.
  - .3 Ventilate temporary sanitary facilities.
- .6 Do not use permanent building heating and ventilation systems during construction.

**1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING**

- .1 Connect to and use the City's existing electrical supply for temporary use during construction.
  - .1 Usage at no cost to Contractor.
- .2 Maximum power supply available for temporary use during construction is limited to existing power supply at the building.
  - .1 230 V.

- .3 Arrange and pay for necessary connections and disconnections of temporary power and lighting in accordance with regulatory requirements.

**1.5 SHUT DOWN AND START-UP OF EXISTING UTILITIES AND HVAC SYSTEMS**

- .1 Co-ordinate shut down and start-up of existing utilities and HVAC systems with the Contract Administrator and the City.
- .2 Comply with the City facilities maintenance requirements for shut down and start-up of systems.
  - .1 Provide a minimum of 48 hours written notification to the City.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA S269.2-16, Access scaffolding for construction purposes.

**1.2 SUBMITTALS**

- .1 Submittals shall be in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Scaffolding: Where Manitoba Regulation 217/2006 requires scaffolds to be designed by a professional engineer, submit Shop Drawings bearing the seal of professional engineer registered in the Province of Manitoba.
- .3 Site Storage Layout Plan:
  - .1 Where storage of materials on the roof structure are proposed, submit storage layout plan including the following:
    - .1 Design load of structure supporting the storage material.
    - .2 Load and area of each storage material.
    - .3 Location of each storage material in relation to supporting structure.
    - .4 Sequence of loading and unloading of storage material on existing structure.
  - .2 Site storage layout plan to be designed and sealed by a professional engineer licenced to practice in the Province of Manitoba.

**1.3 CONSTRUCTION FACILITIES - GENERAL**

- .1 Provide temporary construction facilities as necessary for performance of the Work and in compliance with applicable regulatory requirements.
- .2 Maintain temporary construction facilities in good condition for the duration of the Work.
- .3 Remove temporary construction facilities from place of the Work when no longer required.

**1.4 CONSTRUCTION PARKING**

- .1 Limited parking will be permitted at the place of the Work:
  - .1 Construction parking shall not disrupt continuing operation of the facility.

**1.5 VEHICULAR ACCESS**

- .1 Provide and maintain adequate access to place of the Work. Do not disrupt existing site roads.
- .2 Restrict construction equipment and vehicular access to established roads on Site.

**1.6 SITE OFFICES**

- .1 Further to Section E, provide Contractor Site office as follows:
  - .1 Provide a temperature controlled and ventilated office, with suitable lighting, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
  - .2 Locate site office:
    - .1 Within the Contractor compound.
    - .2 As approved by the City as discussed at the pre-construction meeting.

**1.7 SANITARY FACILITIES**

- .1 Provide sanitary facilities for workers.
- .2 Do not use permanent washroom facilities during construction.
- .3 Keep sanitary facilities clean and fully stocked with the necessary supplies.
- .4 Exterior water connections are available for use by the Contractor for portable facilities.

**1.8 FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection systems and equipment during construction.

**1.9 USE OF EXISTING ELEVATORS**

- .1 Existing elevators shall not be used for construction purposes.

**1.10 SCAFFOLDING**

- .1 Provide and maintain scaffolding as required for access throughout duration of the Work.
- .2 Design and erect scaffolding in accordance with Manitoba Regulation 217/2006 and CAN/CSA S269.2.
- .3 Repair landscape and building damage caused by use of scaffolding.

**1.11 AERIAL DEVICES**

- .1 Provide, use and maintain aerial devices in accordance with Manitoba Regulation 217/2006.
- .2 Provide traffic control for use of aerial device around perimeter of building.
- .3 Store aerial device within City designated area.
- .4 Repair landscape damage caused by use of aerial device.

**1.12 SITE STORAGE/LOADING**

- .1 Design site storage plan within limits of existing structure by an Engineer.
- .2 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with product stockpiles.
- .3 Do not load or permit to load any part of Work with weight or force that will endanger Work.

**1.13 EQUIPMENT, TOOL AND MATERIALS STORAGE**

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

**1.14 CLEAN-UP**

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



**Part 2            Products**

**2.1                NOT USED**

.1                Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not used.

**END OF SECTION**

## **Part 1            General**

### **1.1                BARRIERS AND ENCLOSURES - GENERAL**

- .1    Provide temporary barriers and enclosures necessary to delineate Contractor construction areas and to protect personnel at the WTP.
- .2    Comply with applicable regulatory requirements.
- .3    Maintain temporary barriers and enclosures in good condition for the duration of the Work.
- .4    Remove temporary barriers and enclosures from Place of the Work when no longer required.
- .5    Repair surface coatings, finishes which are damaged by temporary barriers and enclosures.
- .6    Provide adequate signage, fencing, and other informational systems to inform the City staff of the work being undertaken.

### **1.2                FENCING**

- .1    Barricade area under construction with fencing to prevent the general public from improper access.
  - .1    Erect temporary site enclosure around each active Work area using 1.8 m high pre-fabricated welded galvanized steel tube and wire mesh fence panels.
  - .2    Provide metal bottom brackets with weights or other means to secure in place.
  - .3    Provide locking top pins to secure fence sections together.
  - .4    Secure fencing to adjacent structure for continuity of compound.
- .2    Maintain site fencing in good repair until removed.
- .3    Provide lockable access gates as required to facilitate construction access.

### **1.3                WEATHER ENCLOSURES**

- .1    Provide weather tight enclosures to unfinished window openings, tops of shafts and other openings in floors and roofs.
- .2    Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.
- .3    Design weather enclosures to withstand wind pressure and snow loading requirements.

### **1.4                DUST TIGHT SCREENS AND PARTITIONS**

- .1    Provide dust tight screens and partitions to localize interior building areas from dust generating activities.
- .2    Erect, maintain, and relocate screens and partitions as required to facilitate construction operations and the City's operational requirements.
- .3    Refer to Section 01 56 18 – Temporary Facility Protection for protection of facility tanks, vessels and equipment.

### **1.5                FIRE ROUTES**

- .1    Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.

**1.6 PROTECTION OF BUILDING FINISHES**

- .1 Provide necessary temporary barriers and enclosures to protect existing and completed or partially completed finished surfaces from damage during performance of the Work.

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

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

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                DESCRIPTION**

- .1        Work of this Contract involves replacement of roofing overtop of the WTP facility, which is required to remain operational throughout construction. The WTP facility includes open process tanks, channels and other equipment open to the underside of the roof structure. This section describes the protection requirements to prevent contamination of facility operations from construction activities.

**1.2                FACILITY PROTECTION - GENERAL**

- .1        Design, phase, install, and maintain facility protection in accordance with this section.
- .2        Design facility protection to prevent construction activity Work from creating contamination entering facility operation vessels, tanks and equipment.
- .3        Comply with applicable regulatory requirements.
- .4        Maintain facility protection in good condition for the duration of the Work.
- .5        Remove facility protection from place of the Work when no longer required.
- .6        Repair surface coatings, finishes which are damaged by temporary barriers and enclosures.
- .7        Repair, or patch any holes resulting from temporary anchorages required to implement the facility protection.
- .8        Provide adequate signage and other informational systems to inform the WTP personnel of the work being undertaken.

**1.3                FACILITY PROTECTION – DESIGN**

- .1        Design facility protection as follows:
  - .1        Design protection to withstand forces of dust, debris and waste from falling into and contaminating WTP operations tanks, vessels and equipment.
  - .2        Design protection to allow for periodic removal of construction generated dust, debris and waste collected on top of the facility protection.
  - .3        Design and phase facility protection to be capable to span over WTP tanks, vessels and equipment without limiting:
    - .1        Operation of WTP operations,
    - .2        WTP personnel access to WTP operations, and
    - .3        Lighting and ventilation provided to WTP plant.
  - .4        Design, implement and maintain a facility protection maintenance program to:
    - .1        Review installed facility protection.
      - .1        Minimum frequency: At the beginning and end of each work shift.
    - .2        Repair deficiencies and damage to facility protection.
    - .3        Remove debris collected on top of facility protection.
    - .4        Create records of facility protection reviews, maintenance and material removal collected on top of the facility protection.
  - .5        Maintain fire access and egress routes, including overhead clearances.
- .2        Facility protection to be designed and sealed by a professional engineer licenced to practice in the Province of Manitoba.

**1.4 PRE-INSTALLATION CONFERENCE**

- .1 Coordinate a pre-installation conference in accordance with Section 01 31 19 – Project Meetings prior to installation of facility protection.
  - .1 The Contract Administrator will invite facility operations staff to attend the pre-installation conference as required.

**1.5 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit facility protection shop drawings as follows:
  - .1 Floor plans outlining:
    - .1 Phasing of facility protection in relation to active construction on roof.
    - .2 Location of facility protection and WTP tanks, vessels and equipment being protected.
  - .2 Details showing:
    - .1 Locations and method of support structure.
    - .2 Method of support to existing structure.
      - .1 Verify existing structure is capable of supporting facility protection and potential construction generated dust, debris and waste.
- .3 Submit facility protection maintenance program.
- .4 Submit records of facility protection maintenance on a weekly basis.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                TEMPORARY CONTROLS - GENERAL**

- .1     Provide temporary controls as necessary for performance of the Work and in compliance with applicable regulatory requirements.
- .2     Maintain temporary controls in good condition for the duration of the Work.
- .3     Remove temporary controls and Construction Equipment used to provide temporary controls from place of the Work when no longer required.

**1.2                DUST AND PARTICULATE CONTROL**

- .1     Execute Work by methods that minimize dust from construction operations and spreading of dust and debris on site or to adjacent properties.
- .2     Provide temporary enclosures to prevent:
  - .1        Extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.
  - .2        Dust and debris resulting from demolition and construction activities from contaminating facility operations tanks, vessels and equipment. Refer also to Section 01 56 18 – Temporary Facility Protection.
- .3     Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .4     Use appropriate covers on trucks hauling fine, dusty, or loose materials.

**1.3                DEWATERING**

- .1     Provide temporary drainage and pumping as necessary to dewater parts of the Work. Maintain such areas free of water arising from rain and surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.
- .2     Maintain standby equipment necessary to ensure continuous operation of dewatering system.
- .3     Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with applicable regulatory requirements

**1.4                POLLUTION CONTROL**

- .1     Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.
- .2     Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:
  - .1        Authority having jurisdiction,
  - .2        Person causing or having control of pollution source, if known, and
  - .3        The City and Contract Administrator.
- .4     Contact manufacturer of pollutant, if known and applicable, to obtain safety data sheets (SDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.
- .5     Take immediate action to contain and mitigate harmful effects of the spill or release.

**Part 2            Products**

**2.1                NOT USED**

**Part 3            Execution**

**3.1                NOT USED**

**END OF SECTION**

## **Part 1            General**

### **1.1                GENERAL**

- .1 Provide products that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by the Contract Administrator, furnish evidence as to type, source and quality of products provided.
- .2 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.
- .3 Permanent manufacturer's markings, labels, trademarks, and nameplates on products are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.
- .4 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .5 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .6 Should disputes arise as to quality or fitness of products, decision rests strictly with the Contract Administrator based upon requirements of Contract Documents.

### **1.2                PRODUCT OPTIONS**

- .1 Product options are subject to the provisions of B7 - Substitutes and are to be requested during bidding stage only:
  - .1 Wherever a product or manufacturer is specified by a single proprietary name, provide the named product only.
  - .2 Wherever more than one product or manufacturer is specified by proprietary name for a single application, provide any one of the named products.
- .2 Wherever a product is specified by reference to a standard only, provide any product that meets or exceeds the specified standard. If requested by the Contract Administrator, submit information verifying that the proposed product meets or exceeds the specified standard.
- .3 Wherever a product is specified by descriptive or performance requirements only, provide any product that meets or exceeds the specified requirements. If requested by the Contract Administrator, submit information verifying that the proposed product meets or exceeds the specified requirements.
- .4 Wherever a product is specified by descriptive or performance requirements and specific products are identified as basis of design, provide the product identified as the basis of design or any product that meets or exceeds the specified requirements. If requested by the Contract Administrator, submit information verifying that a proposed product not identified as a basis of design meets or exceeds the specified requirements.

### **1.3                PRODUCT AVAILABILITY AND DELIVERY TIMES**

- .1 Promptly upon Contract award and periodically during construction, review and confirm product availability and delivery times. Order products in sufficient time to meet the construction progress schedule and the Contract Time.
- .2 If a specified product is no longer available or has become unavailable due to unforeseen circumstances, submit a substitution request in the format of an RFI, along with an



appended substitution request form located in Section 01 61 00.10 – Substitution Request Form. Product substitutions without cause and that should have been proposed during the bid stage as outlined in 1.2.1 will not be contemplated by the Contract Administrator.

- .1 If the alternative product is accepted for use in the Contract for reasonable cause, the Contract Administrator will prepare a Proposed Change Notice (PCN) and associated Change Work Order (CWO) to document the product change.
- .3 If delivery delays are foreseeable, for any reason, promptly notify the Contract Administrator.
  - .1 If a delivery delay is beyond Contractor's control, the Contract Administrator will provide direction.
  - .2 If a delivery delay is caused by something that was or is within Contractor's control, Contractor shall propose actions to maintain the construction progress schedule for the Contract Administrator's review and acceptance.
- .4 In event of failure to notify the Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.4 STORAGE, HANDLING, AND PROTECTION**

- .1 Store, handle, and protect products during transportation to place of the Work and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.
- .2 Comply with manufacturer's instructions for storage, handling and protection.
- .3 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.
- .4 Comply with the requirements of the workplace hazardous materials information system (WHMIS 2015) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of safety data sheets (SDS).
- .5 Store products subject to damage from weather in weatherproof enclosures.
- .6 Store sheet products on flat, solid, supports and keep clear of ground. Slope to shed moisture.
- .7 Store cementitious products clear of earth or concrete floors, and away from walls.
- .8 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .9 Remove and replace damaged products.
- .10 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

**Part 2            Products**

**2.1                NOT USED**

**Part 3            Execution**

**3.1                NOT USED**

**END OF SECTION**



**Substitute Product Limitations:**

Provide summary of limitations of substitute product and modifications required to system design to accommodate substitution request.

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**Project References:**

Provide minimum of three project references where substitute product has successfully been used.

| Project | Location | Prime Consultant | Year Constructed |
|---------|----------|------------------|------------------|
|         |          |                  |                  |
|         |          |                  |                  |
|         |          |                  |                  |

The undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all aspects to the specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts as applicable is available for the proposed substitution as for specified product.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule, and will not result in any increase in costs to the City except as expressly set out herein.
- Proposed substitution does not affect dimensions and functional clearances.
- No payment to the Contractor will be made for changes to building design, including the Contract Administrator's design, detailing and construction costs caused by substitution. Contractor responsible for all costs associated with the substitution.

Submitted by (Print): \_\_\_\_\_ e-mail address: \_\_\_\_\_

Submitted by (signature): \_\_\_\_\_ Telephone No.: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

**Part 1            General**

**1.1                DESCRIPTION**

- .1            This section specifies the cleaning and waste management requirements to be adhered to through the course of the Work.

**1.2                REGULATORY REQUIREMENTS**

- .1            Comply with applicable regulatory requirements when disposing of waste materials.
- .2            Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

**1.3                GENERAL CLEANING REQUIREMENTS**

- .1            Provide adequate ventilation during use of volatile or noxious substances.
  - .1            Do not rely on building ventilation systems for this purpose.
- .2            Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .3            Prevent cross-contamination during the cleaning process.
- .4            Notify the Contract Administrator of the need for cleaning caused by the City or other contractors.

**1.4                PROGRESSIVE CLEANING AND WASTE MANAGEMENT**

- .1            Maintain the Work in a tidy and safe condition, free from accumulation of waste materials and construction debris.
- .2            Provide appropriate, clearly marked, containers for collection of waste materials and recyclables.
  - .1            Locate containers:
    - .1            Where indicated during the pre-construction meeting.
- .3            Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each Working Day. Collect packaging materials for recycling or reuse.
- .4            Remove waste materials and recyclables from place of the Work at regular intervals.
- .5            Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.
- .6            Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.

**1.5                FINAL CLEANING**

- .1            Remove from Place of the Work surplus Products, waste materials, recyclables, temporary work, and construction equipment not required to perform any remaining work.
- .2            Re-clean as necessary areas that have been accessed by Contractor's workers.
- .3            Remove stains, spots, marks, and dirt from finished surfaces, electrical and mechanical fixtures, furniture fitments, walls, floors and other surfaces within Work area.
- .4            Remove dust from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces within Work area.
- .5            Remove stains, spots, marks, and dirt from exterior facades within Work area.

- .6 Clean exterior window glass and frames within Work area.
- .7 Clean and sweep roofs and clear roof drains within Work area.
- .8 Broom clean and wash exterior walks, steps and surfaces within extents of Work area.

**1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.
- .2 Do not burn or bury waste materials at place of the Work.
- .3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from place of the Work, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.
- .4 Cover or wet down dry waste materials to prevent blowing dust and debris.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 Procedures and requirements for Substantial Performance of the Work and Total Performance of the Work.

**1.2 SUBMITTALS**

- .1 Substantial Performance:
  - .1 Submit a written application for review of substantial performance, including attachments specified in this section in electronic PDF format via e-mail.
  - .2 Submit to:
    - .1 The Contract Administrator:
      - .1 In accordance with Section D.
      - .2 Contract administration: contractadmin@ckpeng.com.
    - .2 The City's project manager at e-mail address identified at the pre-construction meeting.
  - .2 Total Performance:
    - .1 Submit a written application for review of Total Performance, including attachments specified in this section in electronic PDF format via e-mail.
    - .2 Submit to:
      - .1 The Contract Administrator:
        - .1 In accordance with Section D.
        - .2 Contract administration: contractadmin@ckpeng.com.
      - .2 The City's project manager at e-mail address identified at the pre-construction meeting.

**1.3 SUBSTANTIAL PERFORMANCE OF THE WORK**

- .1 The prerequisites to, and the procedures for, attaining substantial performance of the Work, or similar such milestone as provided for in the lien legislation applicable to the Place of the Work, shall be:
  - .1 In accordance with the lien legislation applicable to the place of the Work.
  - .2 As specified in this section.
- .2 Further to Section D the Contractor shall:
  - .1 Contractor's Inspection:
    - .1 Before applying for the Contract Administrator's review to establish Substantial Performance:
      - .1 Ensure that the specified prerequisites to Substantial Performance of the Work are completed,
      - .2 Conduct an inspection of the Work to identify defective, deficient, or incomplete work,
      - .3 Prepare a comprehensive and detailed list of items to be completed or corrected, and
      - .4 Provide an anticipated schedule and costs for items to be completed or corrected.
  - .2 Contract Administrator's Review:
    - .1 Submit to the Contract Administrator a written application for review of Substantial Performance.

- .2 Include the following in the application:
    - .1 Project name and City tender number,
    - .2 Name of contractor submitting the request,
    - .3 Description of the Work Substantial Performance is being requested,
    - .4 Date request submitted,
    - .5 Date review requested, and
    - .6 Results of Contractor Inspection, including:
      - .1 List of items to be completed or corrected.
      - .2 Verification that items have been completed or corrected, or
      - .3 Schedule and costs for items to be completed or corrected.
  - .3 Upon receipt of the Contractor's application for review, together with the Contractor's list of items to be completed or corrected, the Contract Administrator, the City, and the Contractor shall jointly review the Work being requested for Substantial Performance.
  - .4 The Contract Administrator will advise the Contractor whether or not the Work is considered to have attained Substantial Performance. The Contract Administrator will add additional items, if any, to the Contractor's list of items to be completed or corrected. Provide the Contract Administrator with a copy of the revised list.
  - .5 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The Contractor's inspection and Contract Administrator's review procedures specified above shall be repeated until the Work is considered to have attained Substantial Performance and no items remain on the Contractor's list of items to be completed or corrected.
  - .6 When the Contract Administrator determines that the Work has attained Substantial Performance, the Contract Administrator will issue a Certificate of Substantial Performance for the Work.
- .3 Certificate of Substantial Performance
- .1 The Certificate of Substantial Performance will:
    - .1 Document deadline for application of liens and release of statutory holdback requirements in accordance with lien legislation applicable to the place of the Work.

#### **1.4 TOTAL PERFORMANCE**

- .1 The prerequisites to attaining Total Performance of the Work are described in Parts C - General Conditions and D – Supplementary Conditions.
  - .1 Completion of all close-out submittals in accordance with Section 01 78 00 – Close-out Submittals is considered a pre-requisite for Total Performance.
- .2 Review Before Total Performance:
  - .1 Schedule a review for Total Performance as specified below upon completion of the prerequisites for Total Performance as specified in Parts C - General Conditions and D – Supplementary Conditions.
  - .2 Contractor's Inspection:
    - .1 Before applying for the Contract Administrator's review to establish Total Performance:



- .1 Review any previously issued Certificates of Substantial Performance and associated lists of items for completion and correction.
    - .1 Ensure items on lists are now complete.
    - .2 Create an updated list of items to be completed or corrected.
  - .2 Ensure that the specified prerequisites to Total Performance are completed.
  - .3 Conduct an inspection of the Work to identify defective, deficient, or incomplete work.
  - .4 Prepare a comprehensive and detailed list of items to be completed or corrected.
  - .5 Provide an anticipated schedule and costs for items to be completed or corrected.
- .3 Contract Administrator's Review:
- .1 Submit a written application for review of Total Performance.
  - .2 Include the following in application:
    - .1 Project name and City tender number,
    - .2 Name of Contractor submitting the request,
    - .3 Date request submitted,
    - .4 Date review requested, and
    - .5 Results of Contractor Inspection, including:
      - .1 Updated lists from previously issued Certificates of Substantial Performance.
      - .2 List of items to be completed or corrected.
      - .3 Verification that items have been completed or corrected, or
      - .4 Schedule and costs for items to be completed or corrected.
    - .6 Verification of Contract Administrator's final review of closeout submittals in accordance with Section 01 78 00 – Closeout Submittals.
  - .3 Upon receipt of the Contractor's application for review, together with the Contractor's list of items to be completed or corrected and verifications of completed pre-requisites for Total Performance, the Contract Administrator, the City, and the Contractor shall jointly review the Work for Total Performance.
  - .4 The Contract Administrator will advise the Contractor whether or not the Work has attained Total Performance. Add additional items, if any, to the Contractor's list of items to be completed or corrected. Provide the Contract Administrator with a copy of the revised list.
    - .1 Include on the list verifications for the following if required by the Contract Documents:
      - .1 Close-out submittals.
  - .5 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work.
  - .6 The Contractor's inspection and Contract Administrator's review procedures specified above shall be repeated until the Work attains Total Performance and no items remain on the Contractor's list of items to be completed or corrected.

- .7 When the Contract Administrator determines that the Work has attained Total Performance, the Contract Administrator will issue a Certificate of Total Performance.
- .3 Certificate of Total Performance:
  - .1 The Certificate of Total Performance will document the:
    - .1 Date of Total Performance, and
    - .2 Commencement of warranty period.
- 1.5 FINAL PAYMENT**
  - .1 In accordance C12.
- 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            OPERATION AND MAINTENANCE MANUAL**

- .1 Prepare a comprehensive operation and maintenance manual, in the English language, using personnel qualified and experienced for this task.
- .2 Submissions:
  - .1 Draft version:
    - .1 Submit an initial draft of the operation and maintenance manual in electronic PDF format to:
      - .1 The Contract Administrator:
        - .1 In accordance with Section D.
        - .2 Contract administration: contractadmin@ckpeng.com.
      - .2 If required by Contract Administrator review comments, revise manual contents and resubmit for Contract Administrator review. If required, repeat this process until the Contract Administrator returns the submittal with no additional change comments.
      - .3 Schedule draft submission to Contract Administrator to allow:
        - .1 Minimum seven (7) Calendar days for each Contract Administrator review.
        - .2 Preparation and submission of the final version before the specified date of Total Performance.
    - .2 Final version:
      - .1 Upon Contract Administrator return of the draft version with no additional change comments, prepare the final version.
      - .2 Submit final version:
        - .1 In electronic PDF format to:
          - .2 The Contract Administrator:
            - .1 In accordance with Section D.
            - .2 Contract administration: contractadmin@ckpeng.com.
          - .3 Hard copies: Provide three (3) bound hard copy sets to the Contract Administrator in accordance with Section D.
        - .3 Submit before the specified date of Total Performance in the Contract.

### **1.2            OPERATION AND MAINTENANCE MANUAL FORMAT**

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, three D-rings, loose leaf, 216 x 279 mm (8.5" x 11"), with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Binder cover and title sheet:
  - Operation and Maintenance Manual
  - City of Winnipeg
  - Drinking Water Treatment Plant
  - Roof Replacement
  - .1 City of Winnipeg: Water and Waste Department
  - .2 Contract Administrator: Crosier Kilgour & Partners Ltd.
  - .3 Contractor: Insert name of Contractor.

- .4 Date of Submission
- .5 Arrange content by Section number and sequence of Table of Contents.
- .6 Table of Contents:
  - .1 Title of project;
  - .2 Date of submission;
  - .3 Contact Information:
    - .1 Table 1 – Primary: names, addresses, telephone numbers and name of responsible parties for:
      - .1 City of Winnipeg.
      - .2 Contract Administrator.
      - .3 Contractor.
    - .2 Table 2 – Secondary: names, addresses, telephone numbers and name of responsible parties for:
      - .1 Sub-consultants, including field of expertise.
      - .2 Sub-contractors, including scope of work.
  - .4 Schedule of products indexed by specification section:
    - .1 Sub-divide each section with the following:
      - .1 Shop Drawings.
      - .2 Product Data/brochures.
        - .1 Supplement product data with typewritten text in format and style consistent with document.
      - .3 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.
      - .4 Test reports.
      - .5 Warranties.
      - .6 Manufacturer use, care and cleaning instructions.
      - .7 Training materials.
- .7 Provide tabbed fly leaf for each separate Section, with typed description of Product and major component parts of equipment,
- .8 Text: Manufacturer's printed data, or typewritten data, and
- .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

### **1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT**

- .1 Table of contents for each volume.
- .2 Introductory information including:
  - .1 Date of manual submission.
  - .2 Complete contact information for Contract Administrator, subconsultants, other consultants, and Contractor, with names of responsible parties.
  - .3 Schedule of Products and systems indexed to content of volume.
- .3 For each Product or system, include complete contact information for Subcontractors, Suppliers and manufacturers, including local sources for supplies and replacement parts.
- .4 Product Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.
- .5 Reviewed Shop Drawings.

- .6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.
- .7 Warranties.
- .8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

**1.4 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT**

- .1 Separate each warranty with index tab sheets keyed to table of contents listing.
- .2 List each warrantor with complete contact information.
- .3 Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in the City's name.

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

- .1 Supply spare parts, maintenance materials, and special tools in quantities specified in technical Specifications sections.
- .2 Ensure spare parts and maintenance materials are new, not damaged nor defective, and of same quality, manufacturer, and batch or production run as installed Products.
- .3 Provide tags for special tools identifying their function and associated Product.
- .4 Deliver to and store items at a location directed by the Contract Administrator at place of the Work. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.
- .5 Catalogue all items and submit to Contract Administrator an inventory listing organized by Specifications section. Include Contract Administrator reviewed inventory listing in operation and maintenance manual.

**1.6 AS-BUILT DRAWINGS**

- .1 Mark-up drawings and label as "As-Built" drawings in accordance with Section 01 32 00 – Construction Progress Documentation.
- .2 Scan marked-up "As-Built" drawings and submit in electronic PDF format to the Contract Administrator:
  - .1 In accordance with Section D.
  - .2 Contract administration: [contractadmin@ckpeng.com](mailto:contractadmin@ckpeng.com).

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

**Part 1            General**

**1.1                DESCRIPTION**

- .1        This section specifies requirements for demolishing, salvaging, and removing and disposal of waste and debris generated of various items designated to be removed or partially removed to facilitate replacement of roofing.

**1.1                QUALITY ASSURANCE**

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

**1.2                SITE CONDITIONS**

- .1        Hazardous Materials:
  - .1        Should material resembling asbestos or other hazardous material be encountered, stop work, take preventative measures, and notify the Contract Administrator immediately.
    - .1        Do not proceed until written instructions have been received from the Contract Administrator.
  - .2        Notify Contract Administrator 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.
  - .2        The building will be occupied continuously over the duration of the Work. Access to the building is to be maintained. Protect entrance and egresses to the building.
  - .3        Vehicle and barrier free access to the building entrances and exits must be maintained at all times during the course of the work.
- .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 items at the 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 the Work Area.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate waste materials for reuse and recycling in accordance with each specification section.

**Part 2            Execution**

**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.
- .4 Demonstrate that tools are being used in a manner which allows for salvage of materials in the best condition possible.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Inspect building and Site with the City and Contract Administrator and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage, and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 If required, notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the as-built drawings. Support, shore up, and maintain pipes and conduits encountered.
  - .1 Immediately notify Contract Administrator and utility company concerned in case of damage to any utility or service, designated to remain in place.
  - .2 Immediately notify the Contract Administrator should uncharted utility or service be encountered and await instruction in writing regarding remedial action.

#### **3.2 PROTECTION**

- .1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of the building to remain in place. Provide bracing and shoring required.
- .2 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.
- .3 Ensure that exposed areas of deck and/or roof are protected, and weather sealed before departing the site each day. Contractor to be responsible for remediation of any areas damaged due to lack of site protection.
- .4 Keep noise, dust, and inconvenience to occupants to a minimum.
- .5 Protect building systems, services, and equipment.
- .6 Provide temporary dust screens, covers, railings, supports and other protection as required.

#### **3.3 SALVAGE**

- .1 Refer to demolition drawings and specifications for items to be salvaged for reuse.
- .2 Remove items to be reused, store as directed by the City and Contract Administrator, and re-install under appropriate section of specification.

#### **3.4 SITE REMOVALS**

- .1 Remove items as indicated.

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

**3.5 DEMOLITION**

- .1 Remove parts of existing building to permit new construction. Sort materials into appropriate piles for reuse and recycling.
- .2 Trim edges of partially demolished building elements to tolerances as defined by the Contract Administrator to suit future use.

**3.6 DISPOSAL**

- .1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

**3.7 CLEANING AND RESTORATION**

- .1 In accordance with Section 01 74 00- Cleaning and Waste Management.

**END OF SECTION**



## **Part 1            General**

### **1.1                DESCRIPTION**

- .1        This section describes the procedures for removal of deteriorated concrete and surface preparation for the repair of deteriorated concrete.

### **1.2                REFERENCES**

- .1        Canadian Standards Association (CSA)
  - .1        CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.
- .2        International Concrete Repair Institute (ICRI)
  - .1        ICRI Concrete Repair Terminology (2010 Edition).

### **1.3                DEFINITIONS**

- .1        Delamination: A separation along a plane parallel to a surface as in the separation of a coating from a substrate or the layers of a coating from each other, or in the case of a concrete slab, a horizontal splitting, cracking, or separation of a slab in a plane roughly parallel to, and generally near, the upper surface.
- .2        Laitance: A weak layer of cement and aggregate fines on a concrete surface that is usually caused by an overwet mixture, overworking the mixture or excessive finishing, underwater concrete placement, or combinations thereof.
- .3        Sounding: A technique to evaluate the condition of hardened concrete by striking the surface with a hammer; sound concrete will exhibit a clear ringing sound, whereas dull or hollow sounds indicate delaminated areas.
- .4        Spall: A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the larger mass; a small spall involves a roughly circular depression not greater than 120 mm in depth and 150 mm in any dimension; a large spall, may be roughly circular or oval or in some cases elongated, is more than 20 mm in depth and 150 mm in greatest dimension.
- .5        Substrate: The layer immediately under a layer of different material to which it is typically bonded; an existing concrete surface that receives an overlay, partial-depth repair, protective coating, or some other maintenance or repair procedure.
- .6        Surface Preparation: The process whereby a method or combination of methods is used to remove deteriorated or contaminated concrete and roughen and clean a substrate to enhance bond of a repair material or protective coating.
- .7        Surface Profile: The topographic contour of the exposed surface of a material or substrate.

### **1.4                SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2        Qualification Statements:
  - .1        Contractor Qualifications Statement:

- .1 Provide 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 Provide minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.
- .2 Site Superintendent Qualification Statement:
  - .1 Provide minimum 5 examples of local projects demonstrating successful performance as site superintendent of concrete repairs of similar size and complexity to specified Work within the last 3 years.
  - .2 Provide minimum 3 references exhibiting successful performance as site superintendent of concrete repairs within the last 5 years.

## 1.5 QUALITY ASSURANCE

- .1 Contractor Qualifications:
  - .1 Minimum of 5 years of experience in the repair and restoration of concrete structures.
  - .2 Site Superintendent to have a minimum of 5 years of experience exhibiting successful performance in concrete restoration projects.
  - .3 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.

## 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 13kg electric or pneumatic chipping hammers.
  - .2 Final removal and undercutting of reinforcing steel: maximum 6.8 kg electric chipping hammers.
  - .3 Bulk removal of full depth repairs: electric or pneumatic jack hammers with weight ratings above 13 kg may be used upon approval by the Contract Administrator.
  - .4 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 Blast medium: Shall be consistent with the equipment, site conditions, and capable of obtaining the specified surface profile.
- .3 High pressure waterblast: capable of maintaining a sustained pressure of not less than 27 580 kilopascals (4,000 psi).

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Repairs areas will be identified on-site by the Contract Administrator in the presence of and with the assistance of the Contractor. The approximately periphery of the repair will be marked on the surface of the member and the location and extent recorded on drawings.
- .2 Allow time in the Schedule for survey and inspection work carried out by the Contract Administrator ahead of repairs. Provide sufficient safe access to enable review of all areas designated for repairs.
- .3 The Contractor shall make available, as required throughout the Contract, labour to carry out the following under the direction of the Contract Administrator:
  - .1 Identification of repairs,
  - .2 Sample chipping and/or drilling, and
  - .3 Operators for access equipment.
- .4 The Contractor shall make available as required throughout the Contract equipment for the use of the Contract Administrator:
  - .1 Marking paint and chalk,
  - .2 Hammer and chain for sounding surveys, and
  - .3 Tape measure.

### **3.2 PREPARATION**

- .1 All necessary measures shall be taken to provide protection to the general public, and 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 Work. Reinstall when restoration work is complete.
- .4 Protect building materials, fixtures and equipment below and adjacent to repair areas from damage.
- .5 The Contractor shall make good or rectify any damage caused as a result of insufficient protection.
- .6 Provide temporary access required to facilitate Work.

### **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 the Contract Administrator of increases in previously identified areas.

- .4 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused more than 1/3 the periphery of a bar to be exposed for a distance of 150 mm (6 inches) or more, the concrete adjacent to the bar shall be removed by maximum 6.8 kg (15 lb.) electric chipping hammers to provide sufficient clearance between the reinforcement and concrete.
  - .1 Provide a minimum 20 mm (3/4 inches) clearance, or 6 mm (1/4 inch) 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 destroyed, exposing the bar will be required.
- .6 The perimeter of the areas marked as delaminated are to be saw cut to a depth of 12 mm (1/2 inch). Feather edging is not permitted. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.
- .7 Ensure sawcut encompasses the boundaries of corrosion that have been established.
- .8 Ensure the entire area within the saw cut is removed to a depth consistent with the type of repair and repair material specified in other Sections.
- .9 Chip patch edges to provide a clean vertical edge along the patch perimeter to the required minimum depth.
- .10 Conduct soundings to determine if any further unsound or delaminated concrete is present, which must be removed.
- .11 After all delaminated, unsound, or loose material is removed, the Contractor shall request an inspection from the Contract Administrator. This inspection 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 inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

### **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-10 or better. Surface profile samples are available for inspection in the Contract Administrator '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.
- .4 Secure any reinforcement which is loose by tying to other secured bars or by other methods approved by the Contract Administrator.
- .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 until the patch material is ready to be placed.

- .7 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the surface preparation and the condition of existing reinforcing steel, if any encountered.
- .8 Final cleaning of the concrete substrate shall consist of a high pressure waterblast substrate at minimum 27 580 kilopascals (4,000 psi) to remove any residual dust and dirt.
- .9 Maintain substrate in a saturated condition for a period of not less than 8 hours prior to infilling. 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 the Contract Administrator. Provide minimum 24 hours notice prior to each phase of the work.
- .2 The Contract Administrator inspection to be completed at the following times:
  - .1 Prior to demolition to identify and quantify repair locations types, and approximate sizes.
  - .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.

**END OF SECTION**

## **Part 1            General**

### **1.1                DESCRIPTION**

- .1        This section specifies procedures to repair hollowcore grouted joints exhibiting extensive spalling and/or delamination by mechanical removal of the deteriorated concrete and infilling with a rapid-setting mortar.

### **1.2                RELATED SECTIONS**

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

### **1.3                REFERENCES**

- .1        American Concrete Institute (ACI)
  - .1        ACI 546-04, Concrete Repair Guide.
  - .2        ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.
- .2        Canadian Standards Association (CSA)
  - .1        CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .3        American Society for Testing and Materials (ASTM)
  - .1        ASTM C39 / C39M – 20, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - .2        ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
  - .3        ASTM C191 – 19, Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
  - .4        ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .5        ASTM C496 / C496M – 17, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
  - .6        ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
  - .7        ASTM C672 / C672M – 12, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
  - .8        ASTM C928 / C928M – 20, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
  - .9        ASTM C1202 – 19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
- .4        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                SUBMITTALS**

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

- .2 Qualification Statements:
  - .1 Provide references of successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

## 1.5 QUALITY ASSURANCE

- .1 Contractor Qualifications:
  - .1 Minimum of five (5) years experience in application of specified (or similar) products on projects of similar size and scope.
  - .2 Successful completion of a minimum of five (5) projects of similar size and complexity to specified Work within the last three (3) years.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Comply with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .4 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .5 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 4°C and rising at application time and remain above 4°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: 21 MPa (3,000 psi).
      - .2 1 Day: 41 MPa (6,000 psi).
      - .3 28 Days: 55 MPa (8,000 psi).

- .3 Compressive Strength, ASTM C39, 76-mm by 152-mm (3-inch by 6-inch) cylinders:
  - .1 28 Days: 51 MPa (7,400 psi).
- .4 Set Time, ASTM C191, 22° C (72° F):
  - .1 Initial: 50 minutes.
  - .2 Final: 80 minutes.
- .5 Splitting Tensile Strength, ASTM C496:
  - .1 1 Day: 2.8 MPa (400 psi).
  - .2 28 Days: 3.1 MPa (450 psi).
- .6 Freeze-Thaw Resistance, ASTM C666, Procedure A, at 300 cycles:
  - .1 100 percent relative dynamic modulus.
- .7 Scaling Resistance, ASTM C672, at 25 cycles:
  - .1 Zero rating; no scaling.
- .8 Length Change, ASTM C928:
  - .1 Drying Shrinkage: Minus 0.05%.
  - .2 Wetting Expansion: Plus 0.03%.
- .9 Rapid Chloride Permeability, ASTM C1202:
  - .1 Less than 300 Coulombs.
- .10 Coefficient of Thermal Expansion, CRD C39:
  - .1  $12.6 \times 10^{-6}$  cm/cm/degree C ( $6.8 \times 10^{-6}$  in/in/degree F).
- .2 Acceptable Product:
  - .1 MasterEmaco T 1061 (formerly known as 10-61 Rapid Mortar) by BASF Building Systems.
  - .2 Or approved equal in accordance with B7 - Substitutes.

## 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 50 – 100 mm (2" – 4") in depth, the minimum recommended addition is 6.8 – 11.4 kg (15 – 25 lbs) of 10 mm (3/8") washed, graded, rounded, SSD, low-absorption, high-density aggregate per 22.7 kg (50 lb) bag.
  - .2 For areas greater than 100 mm (4") in depth, the minimum recommended addition is 11.4 – 22.7 kg (25 – 50 lbs) of 10 mm (3/8") washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb bag.
  - .3 The maximum aggregate extension is 22.7 kg (50 lbs) of pea gravel per bag.
- .2 Evaporation retardant:
  - .1 Acceptable products:
    - .1 MasterKure ER 50 (formerly known as Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
    - .2 Or approved equal in accordance with B7 - Substitutes.
- .3 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
  - .1 Acceptable products:
    - .1 Florseal WB-18 by Sika Canada Inc. at a minimum application rate of 4.9 m<sup>2</sup>/L.
    - .2 MasterKure CC 160 WB, (formerly known as Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
    - .3 Or approved equal in accordance with B7 - Substitutes.



### **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 the Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

#### **3.2 INFILLING PROCEDURES**

- .1 Obtain the Contract Administrator'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 and horizontal extended 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. An 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 3.1 mm (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 to assure good bond.
- .6 Ensure that the rate of placing is sufficient to complete the 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 to match existing.
- .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 a minimum of 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 75 mm (3 inches) 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 CSA testing laboratory in accordance with CSA A23.1.
- .2 Frequency of tests:
  - .1 Not less than one test per 4.6 m<sup>2</sup> (50 square feet) of patching material placed, and
  - .2 Not less than one test for each day of placement.
- .3 Prepare and test samples at a CSA Certified laboratory in accordance with ASTM C109.
- .4 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

### **3.6 DEFECTIVE CONCRETE**

- .1 Defective concrete means 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 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 the Contract Administrator for each individual use.

**END OF SECTION**

**Part 1            General**

**1.1            DESCRIPTION**

- .1        This section covers the removal and replacement of scaled surface areas the structural deck to provide a smooth surface for installation of the membrane.

**1.2            RELATED SECTIONS**

- .1        Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.

**1.3            REFERENCES**

- .1        American Concrete Institute (ACI)
  - .1        ACI 546-04, Concrete Repair Guide.
- .2        American Society for Testing and Materials (ASTM)
  - .1        ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
  - .2        ASTM C266 – 18, Standard Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles.
  - .3        ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .4        ASTM C348 – 20, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
  - .5        ASTM C469 / C469M – 14, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
  - .6        ASTM C496 / C496M – 17, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
  - .7        ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
  - .8        ASTM C672 / C672M – 12, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
  - .9        ASTM C882 / C882M – 20, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
  - .10       ASTM C928 / C928M – 20, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
  - .11       ASTM C1202 – 19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
- .3        Canadian Standards Association (CSA)
  - .1        CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4        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 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Qualification Statements:
  - .1 Provide references of successful completion of a minimum of five (5) projects of similar size and complexity to specified Work within the last three (3) years.

#### **1.5 QUALITY ASSURANCE**

- .1 Contractor Qualifications:
  - .1 Minimum of five (5) years experience in application of specified (or similar) products on projects of similar size and scope.
  - .2 Successful completion of a minimum of five (5) projects of similar size and complexity to specified Work within the last three (3) years.

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

- .1 Comply with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .4 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .5 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 4°C and rising at application time and remain above 4°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 One-component high-performance, cementitious mortar that produces high-early strength and contains modified cement, aggregate, and additives meeting the following performance requirements:
  - .1 Properties
    - .1 Complies with ASTM C928.
    - .2 Compressive Strength, ASTM C109:
      - .1 3 Hour: minimum 6 MPa

- .2 1 Day: minimum 30 MPa.
- .3 7 Days: minimum 50 MPa.
- .3 Set Time, ASTM C266, minimum 21°C:
  - .1 Initial: 75 minutes or less
  - .2 Final: 90 minutes or less.
- .4 Flexural Strength, ASTM C348:
  - .1 1 Day: minimum 4 MPa.
  - .2 7 Days: minimum 6 MPa.
- .5 Modulus of Elasticity at 28 days, ASTM C469: 35 ± 5 GPa.
- .6 Splitting Tensile Strength, ASTM C496:
  - .1 1 Day: minimum 3.5 MPa.
  - .2 7 Days: minimum 7.5 MPa.
- .7 Slant Shear Bond Strength, ASTM C882 Modified:
  - .1 1 Day: minimum 12 MPa.
  - .2 7 Days: minimum 20 MPa.
- .8 Rapid chloride permeability, AASHTO-T277/ASTM C1202: less than 1,000 coulombs.
- .9 Scaling Resistance (weight loss, lb/ft<sup>2</sup>), ASTM C672:
  - .1 25 cycles: CaCl<sub>2</sub>: 0.003, NaCl: 0.067
  - .2 50 cycles: CaCl<sub>2</sub>: 0.005, NaCl: 0.084
- .10 Freeze-Thaw Resistance, ASTM C666, (Procedure A) 100% Relative Dynamic Modulus at 300 cycles: 98.5.
- .2 Acceptable product:
  - .1 MasterEmaco T 430, (formerly known as Emaco T-430) by BASF Building Systems.
  - .2 Or approved equal in accordance with B7 - Substitutes.

## 2.2 ACCESSORIES

- .1 Evaporation retardant:
  - .1 Acceptable products:
    - .1 MasterKure ER 50 (formerly known as Confilm) by BASF Building Systems at a minimum application rate of 4.9 m<sup>2</sup>/L.
    - .2 Or approved equal in accordance with B7 - Substitutes.
  - .2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):
    - .1 Acceptable products:
      - .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.
      - .3 Or approved equal in accordance with B7 - Substitutes.

## Part 3 Execution

### 3.1 SCALING REMOVAL PROCEDURES

- .1 The Contract Administrator will mark out the perimeter of the scaled or debonded areas, which are to be removed as specified herein.

- .2 The Contractor must saw-cut the perimeter of the scaled repair area to 6 mm ( $\frac{1}{4}$ " ) using wet cut methods. Removal of the scaled material shall be accomplished by the use of a short stroke electric chipping hammer with a sharp bush hammer bit to remove the surface scaling within the marked-out areas.
- .3 Minimum depth of removal will be 6 mm ( $\frac{1}{4}$ " ), and maximum depth will be 25 mm (1") for scaling repairs.
- .4 Once the areas have been bush hammered, the Contractor must chain drag all areas to determine if any further unsound material is present, which must be removed.
- .5 Once the areas are determined by the Contractor to be sound, request a final inspection from the Contract Administrator. This inspection shall be done in the presence of the Contractor, who shall complete any further work at the time of the inspection.
- .6 Within 24 hours prior to infilling, shotblast 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-5 or better. Sample concrete surface preparation profile swatches are available for inspection in the Contract Administrator 's office. These samples will be used as the standard of acceptance.
- .7 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.
- .8 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.

### **3.2 INFILL PROCEDURE**

- .1 Obtain the Contract Administrator's approval before placing repair material. Provide a minimum of 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 horizontal 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 3 mm ( $\frac{1}{8}$ " ) over entire area.
  - .3 Place the 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 re-temper. 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 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 to match existing.
- .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 75 mm (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 CSA testing laboratory in accordance with CSA A23.1.
- .2 Frequency of tests:
  - .1 Not less than one test per 4.6 m<sup>2</sup> (50 square feet) of patching material places, and
  - .2 Not less than one test for each day of placement.
- .3 Prepare and test samples at a CSA Certified laboratory in accordance with ASTM C109.
- .4 Inspection or testing by the Contract Administrator 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 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 the Contract Administrator for each individual use.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 The section describes the removal and replacement of concrete exhibiting extensive spalling and/or delamination at pre-cast concrete panel weld plates and flange edges.
- .2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10 – Surface Preparation of Concrete Delamination Repairs.

**1.2 RELATED SECTIONS**

- .1 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.
- .2 Section 03 95 11 – Epoxy Crack Repair.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
  - .2 ASTM C157/C157M-17, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
  - .3 ASTM C303 - 10(2016)e1, Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
  - .4 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .5 ASTM C518 – 17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - .6 ASTM C531-18, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
  - .7 ASTM C665 – 17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .8 ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
  - .9 ASTM C795 - 08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .10 ASTM E96 / E96M – 16, Standard Test Methods for Water Vapor Transmission of Materials.
- .2 Canadian Standards Association (CSA)
  - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

**1.4 QUALITY ASSURANCE**

- .1 Contractor Qualifications:
  - .1 Minimum of five (5) years experience in application of specified (or similar) products on projects of similar size and scope.
  - .2 Successful completion of a minimum of five (5) projects of similar size and complexity to specified Work within the last three (3) years.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Comply with Section 01 61 00 – Common Product Requirements.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.
- .4 Keep materials in manufacturer's original, unopened containers and packaging until installation.
- .5 Protect materials during storage, handling, and application to prevent contamination or damage.

## **1.6 PROJECT CONDITIONS**

- .1 Environmental Requirements:
  - .1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°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 products:
  - .1 MasterEmaco S 440 by BASF Building Systems.
  - .2 Sikacrete-08 SCC by Sika Canada.
  - .3 Or approved equal in accordance with B7 - Substitutes.

### **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.
  - .3 Or approved equal in accordance with B7 - Substitutes.
- .2 Stonewool Insulation: To CANULC-S702
- .1 Performance criteria:
    - .1 Flame spread index: 0 (Can/ULC S102).
    - .2 Density: 8 lbs/ft<sup>3</sup> (ASTM C303).
    - .3 Corrosion resistance: To ASTM C795 and ASTM C665.
    - .4 Thermal resistance: 4.2 hr.ft<sup>2</sup>/Btu (ASTM C518).
    - .5 Vapour transmission: 31 perms (ASTM E96).
    - .6 Compressive strength: 439 psf (ASTM C165).
    - .7 Thickness: 1.5 inches.
  - .2 Acceptable product:
    - .1 Comfortboard 80 as manufactured by Rockwool.
    - .2 Or approved equal in accordance with B7 - Substitutes.
- .3 Weld Plate Paint:
- .1 Acceptable products:
    - .1 1st Coat:
      - .1 Zinc Clad VI, WB Organic, B69-210 Series.
      - .2 SW B69A45 Zinc-Rich Organic Primer.
    - .2 2nd Coat: Waterbased Tile-Clad Epoxy, B73-100 Series.
    - .3 3rd Coat: Waterbased Tile-Clad Epoxy, B73-100 Series.
    - .4 Or approved equal in accordance with B7 - Substitutes.
  - .2 Colour: to match existing.

## **2.3 FINISHES**

- .1 Materials
  - .1 Paint materials for each coating formulae to be products of a single manufacturer.
  - .2 Provide specified, approved paint, finish materials.
- .2 Acceptable Products
  - .1 Acceptable manufacturers:
    - .1 Sherwin Williams
    - .2 Pratt & Lambert Inc.
    - .3 Glidden Paint Co.
    - .4 Canadian Pittsburgh Industries.
    - .5 Or approved equal in accordance with B7 - Substitutes.
- .3 Acceptable Systems
  - .1 Surface preparation: in accordance with manufacturer's recommendations.
  - .2 Acceptable materials:
    - .1 S-W Duration Exterior Latex Acrylic Satin Coating.
    - .2 Or approved equal in accordance with B7 - Substitutes.
- .4 Colour: to match existing.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Protection:
  - .1 Protect adjacent Work areas and finish surfaces from damage during repair mortar application.
  - .2 Protect areas beneath repair locations from damage from repair activities falling.
- .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 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 space 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 Construct formwork to allow placement of repair materials through openings in the slab from above. Size and location of openings to be approved by the Contract Administrator. Do not remove or cause damage to existing reinforcing steel in order to install placement openings.
  - .8 A minimum of 20 mm concrete cover over the primary reinforcing steel will be required. Adjust/notch formwork as required to ensure sufficient cover.
  - .9 Provide drainage outlets in formwork for presoaking.
  - .10 Provide air venting in formwork.
  - .11 Use form-release agent to facilitate removal of forms from cast material.
  - .12 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 Contract Administrator'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.
- .2 Leave formwork in place until repair mortar reaches compressive strength of 20 MPa or minimum 3 days.
- .3 Upon removal of forms, apply two coats curing compound in accordance with manufacturer's specifications. Apply the first coat immediately upon removal of forms. Apply the second coat about 24 hours later.

### **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 Contract Administrator's written approval.
- .2 Apply epoxy filler to repair perimeter as shown on Drawings and in accordance with Section 03 95 11.
- .3 Paint exposed steel weld plates:
  - .1 Surface preparation: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.
    - .1 Reblast surface if oxidation occurs before application of primer.
    - .2 Surface defects revealed by the blast cleaning process to be ground and filled
  - .2 Apply paint in three coats in accordance with manufacturer's directions.
    - .3 1st Coat: Zinc Clad VI, WB Organic, B69-210 Series (2.0 - 3.0 mils dry).
    - .4 2nd Coat: Waterbased Tile-Clad Epoxy, B73-100 Series (2.0 - 4.0 mils dry per coat).
    - .5 3rd Coat: Waterbased Tile-Clad Epoxy, B73-100 Series (2.0 - 4.0 mils dry per coat).
- .4 At locations where the underside of repair areas are exposed to view, 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 CSA testing laboratory in accordance with CSA-A23.1.
- .2 Frequency of tests:

- .1 Not less than one test per 4.6m<sup>2</sup> (50 square feet) of patching material placed and not less than one test for each day of placement.
- .3 Prepare and test samples at a CSA certified laboratory in accordance with ASTM C109.
- .4 Inspection or testing by the Contract Administrator 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 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 the Contract Administrator for each individual use.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This Section describes the repair of cracks in concrete by placing epoxy into routed cracks.

**1.2 QUALITY ASSURANCE**

- .1 The Contractor or their Sub-contractor must be a trained, approved applicator who is qualified to do epoxy injection for the purpose of structural concrete bonding.
- .2 The applicator shall provide a minimum of three (3) local references exhibiting successful performance in grouting repairs with the specified product.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Epoxy: Super low-viscosity and moisture insensitive, epoxy resin.
  - .1 Acceptable products:
    - .1 Sika: Sikadur 55 SLV manufactured by Sika Canada Inc.
    - .2 Or approved equal in accordance with B7 - Substitutes.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Sawcut reglet along cracks identified by the Contract Administrator.
- .2 Reglet dimensions as shown on Drawings.
- .3 Thoroughly clean 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 Do not proceed with the Work until any unsatisfactory conditions have been corrected in a manner acceptable to the Contract Administrator.
- .7 Provide protection beneath crack location to prevent epoxy draining to areas at underside of slab.

**3.2 PROCEDURE**

- .1 Mix epoxy in accordance with manufacturer directions.
- .2 Apply epoxy to routed crack by roller, squeegee or broom in accordance with manufacturer directions.
- .3 Allow epoxy to penetrate into cracks and substrate. Remove excess, leaving no visible surface film.
- .4 Perform epoxy adhesive application continuously until cracks are completely filled.
- .5 Allow epoxy to cure in accordance with manufacturer directions.



**3.3 CLEANING**

- .1 Finish the face of the crack approximately flush to the adjacent concrete showing no indentations or protrusions caused by the placement.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 07 52 00 – Modified Bituminous Membrane Roofing.
- .2        Section 07 62 00 – Sheet Metal Flashing and Trim.

**1.2                REFERENCES**

- .1        American Society of Mechanical Engineers (ASME):
  - .1        ASME B18.6.1-1981 Wood Screws.
- .2        ASTM International:
  - .1        ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
  - .2        ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - .3        ASTM C303-21, Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
  - .4        ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
  - .5        ASTM C1177/C1177-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .3        Canadian Standards Association (CSA International)
  - .1        CSA O80 Series-08 (R2012), Wood Preservatives
  - .2        CSA O121-08, Douglas Fir Plywood.
  - .3        CSA O141-05, Softwood Lumber.
  - .4        CAN/CSA-O325.0-07, Construction Sheathing.
- .4        Underwriters Laboratories of Canada (ULC).
  - .1        CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre for Buildings.
- .5        National Lumber Grades Authority (NLGA)
  - .1        Standard Grading Rules for Canadian Lumber.

**1.3                QUALITY ASSURANCE**

- .1        Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2        Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

**1.4                DELIVERY, STORAGE, AND HANDLING**

- .1        Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements and with manufacturer's written instructions.
- .2        Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3        Storage and Handling Requirements:
  - .1        Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2        Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 FRAMING AND STRUCTURAL MATERIALS**

- .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Framing and board lumber: in accordance with NBC, except as indicated or specified otherwise.
- .3 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers all to be pressure treated:
  - .1 S2S is acceptable for interior protect areas.
  - .2 Board sizes: "Standard" or better grade.
  - .3 Dimension sizes: "Standard" light framing or better grade.
  - .4 Post and timbers sizes: "Standard" or better grade.

### **2.2 PANEL MATERIALS**

- .1 Plywood and wood based composite panels: to CAN/CSA-O325.0.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Glass reinforced sheathing: to ANSI/UL 790.

### **2.3 ACCESSORIES**

- .1 Sealants:
  - .1 Silicone sealant: Single component, neutral cure, silicone sealant to ASTM C920, Type S, Grade NS, Class 50/50, Use NT, M, A, G, and O.
  - .2 Colour: By the Contract Administrator based on manufacturer standard colour range.
  - .3 Acceptable product:
    - .1 Silicone Sealant 795.
    - .2 Or approved equal in accordance with B7 - Substitutes.
- .2 Nails, spikes, and staples: to ASME B18.6.1.
- .3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .5 Wood screws:
  - .1 Type, size and spacing as indicated on drawings.
  - .2 Stainless steel: use stainless steel 304 alloy.
- .6 Concrete anchor:
  - .1 Heat treated carbon steel with corrosion resistant finish.
  - .2 Size: minimum 6mm diameter.
  - .3 Length: to suit minimum 38 mm embedment into existing substrate, unless indicated otherwise on drawings.

- .4 Corrosion resistant finish:
  - .1 Multi layered application.
  - .2 To ASTM B117.
- .5 Acceptable product: Concrete Anchor.
- .6 Or approved equal accordance with B7 - Substitutes.
- .7 Metal Angles (break metal):
  - .1 Galvanized steel, ASTM A653/A653M Grade 230 with Z275 zinc coating.
  - .2 Thickness: 20 gauge or as otherwise shown on Drawings.
- .8 Batt and blanket stone wool insulation: Type 1 to CAN/ULC S702.
  - .1 Density: >32 kg/m<sup>3</sup> (2 lb/ft<sup>3</sup>) to ASTM C303
  - .2 Thickness: to be friction-fit into all wall cavities and other areas indicated on the drawings.
- .9 Sprayed polyurethane foam to meet the requirements of ULC S705.1.
- .10 Glass reinforced sheathing: mold and moisture resistant support board/panel combining reinforcing glass mat fully embedded into a specially formulated fire and moisture resistive, non-combustible core to ASTM C1177.
  - .1 Thickness: minimum 12.7mm or as otherwise indicated on drawings.

## **2.4 FASTENER FINISHES**

- .1 Hot-dipped galvanizing: use galvanized fasteners for exterior work, interior highly humid areas and pressure-preservative treated lumber.
- .2 Stainless steel: use stainless steel were indicated on drawings.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PREPARATION**

- .1 Treat surfaces of material with wood preservative before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3-minute soak on lumber and one minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming, or boring with liberal brush application of preservative before installation.

### **3.3 MATERIAL USAGE**

- .1 Exterior wall sheathing and parapet built ups:

- .1 Plywood, douglas fir plywood (DFP) exterior grade, square edge, thickness min 13mm (1/2") or unless otherwise indicated on the drawings.
- .2 Interior face of parapets and exterior face of curb wall sheathing:
  - .1 Glass reinforced, moisture resistant support panel, thickness as indicated on drawings.  
or
  - .2 Douglas fir plywood (DFP) sheathing grade, square edge, thickness as indicated on drawings.

### **3.4 INSTALLATION**

- .1 Install members true to line, levels, and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .5 Install furring and blocking as required to space-out and support facings, fascia, soffit, siding, and other work as required.
- .6 Install furring to support siding applied vertically, where there is no blocking and where sheathing is not suitable for direct nailing.
  - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .7 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .8 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .9 Install sleepers as indicated.
- .10 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .11 Countersink bolts where necessary to provide clearance for other work.
- .12 Patch, finish, re-finish interior finishes removed, cut, broken or damaged resulting from the Work.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by rough carpentry installation.

### **3.6 CLEANING**

- .1 Clean in accordance with Section 01 74 00 – Cleaning and Waste Management.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies the requirements for the supply and installation of the modified bituminous membrane roofing system.

**1.2 RELATED SECTIONS**

- .1 Section 06 10 00 – Rough Carpentry
- .2 Section 07 62 00 – Sheet Metal Flashing and Trim

**1.3 REFERENCES**

- .1 Canadian Roofing Contractors Association (CRCA)
  - .1 CRCA Roofing Specifications Manual.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA A123.21-14, Standard test method for the dynamic wind uplift resistance of membrane-roofing systems.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meeting:
  - .1 In accordance with Section 01 31 19 – Project Meetings.
  - .2 Convene a pre-installation meeting a minimum of one (1) week prior to beginning the Work, with the roofing Contractor's representative, the manufacturer's representative, the Contract Administrator, and the City to:
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building sub trades.
    - .4 Review manufacturer's installation instructions and warranty requirements.
    - .5 Review facility protection that may be required.

**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Manufacturer's Certificate:
  - .1 Certify that products and system design meet or exceed specified requirements of CSA A 123.21, Standard Test Method for Dynamic Wind Uplift Resistance of Membrane-Roofing Systems.
  - .2 Provide certification from the manufacturer that the adhesive and/or mechanical anchors utilized in the design and installation exceed the following design live wind loads:
    - .1 -1.4 kPa for the field of the roof.
    - .2 -1.9 kPa for the edge of the roof.
    - .3 -4.2 kPa for the corners of the roof.
    - .4 Note: Load presented have wind load factors applied
- .3 Submit manufacturer's product data and installation instructions for the following:
  - .1 Air vapour barrier membrane, and
  - .2 Membrane roofing system.
- .4 Shop drawings:

- .1 Provide shop drawings indicating:
  - .1 Flashing, control joints, pre-manufactured fittings, roof drains, and details.
  - .2 Tapered (Sloped) insulation:
    - .1 Layout.
    - .2 Details of sloped insulation.
    - .3 Slopes: Minimum slopes indicated on the drawings and at no point less than 1% to drains and/or scuppers.
    - .4 Location and identification of all sloped insulation blocks.
- .5 Closeout Submittals:
  - .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
  - .2 Operation and Maintenance (O&M) Manual:
    - .1 Operation and maintenance data for incorporation into manual, including manufacturer's recommended cleaning instructions for metal components.
  - .3 Submit manufacturer's and Contractor's warranty documentation.

## **1.6 QUALITY ASSURANCE**

- .1 Roofing Contractors and Sub-contractors:
  - .1 Must, when tendering or performing work, possess a roofing Contractor operating license.
  - .2 Roofing Contractors and Sub-contractors must also be currently registered with and approved by the product manufacturer.
  - .3 Only qualified, certified installers employed by a company with the appropriate equipment may execute the roofing work.
- .2 Contractor may switch the roofing foreman through project only upon written permission of Contract Administrator and only after suitable overlap to facilitate transfer of knowledge.
- .3 Field Mock-up:
  - .1 Install field mock-up at Project site or pre-selected area of building or location approved by the Contract Administrator. Install material in accordance with this Section.
  - .2 Location and size of field mock-up will be established during the pre-construction meeting.
  - .3 Field mock-up will be standard for judging workmanship on remainder of Project.
  - .4 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.
  - .5 If Contractor supervisor and installers change during the project, repeat mock-up procedures for each new supervisor and installer at the Site.

## **1.7 FIRE PROTECTION**

- .1 Further the requirement for a Safe Work Plan in Section D and Section 01 35 29 – Safety Procedures, incorporate fire protection into the safe work plan as follows:
  - .1 Prior to the start of Work, conduct a Site inspection to establish safe working practices and make sure that all procedures and proposed changes are approved to minimize the risk of fires.
  - .2 Respect safety measures described in the product manufactures' specifications manual as well as local association recommendations, and the City's requirements.
  - .3 Establish a fire watch to incorporate at minimum:

- .1 At the end of each workday, use a heat detector gun to spot any smouldering or concealed fire.
- .2 Job planning must be strictly organized to ensure workers are still on location at least two (2) hours after torch application (2-hour fire watch).
- .4 Never apply the torch directly to old and wood surfaces.
- .5 Throughout roofing installation:
  - .1 Maintain a clean Site.
  - .2 Provide sufficient quantities of ULC-approved ABC fire extinguisher for the areas under construction.
    - .1 Charged and in perfect operating condition.
    - .2 Locate within 6 metres of each roofing torch.
  - .3 Respect all safety measures described in technical data sheets.
  - .4 Torches must never be placed near combustible or flammable products, nor used where the flame is not visible or cannot be easily controlled.

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 The materials are to remain in their original packaging, displaying the manufacturer's name, product name, weight, and reference standards, as well as all other indications or references considered standard.
- .3 Storage and Handling Requirements:
  - .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS 2015) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
  - .2 Provide and maintain dry, off-ground weatherproof storage.
  - .3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.
  - .4 Avoid material overloads which may affect the structural integrity of specific roof areas.
  - .5 Remove only in quantities required for same day use.
  - .6 Place plywood runways over completed Work to enable movement of material and other traffic.
  - .7 Store sealants at +5 degrees C minimum.
  - .8 Store insulation protected from daylight, weather, and deleterious materials.

### **1.9 FIELD CONDITIONS**

- .1 Ambient Conditions
  - .1 Do not install roofing when temperature remains below the manufacturer's minimum recommended temperature.
  - .2 Minimum temperature for solvent-based adhesive is -5 degrees C.
- .2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

### **1.10 WARRANTY**

- .1 The product manufacturer will issue a written and signed document in the City's name, certifying that the roofing membranes are free of manufacturing defects for a period of ten (10) years, starting from the date of Substantial Performance. This warranty will cover the removal and replacement of defective roof membrane products, including labour. The warranty must remain a full warranty for the duration of the period specified. No letter



amending the manufacturer's standard warranty will be accepted and the warranty certificate must reflect these requirements.

- .2 The Contractor will provide a written and signed document to the City certifying that the work executed will remain in place and free of leakage or other waterproofing defect for a period of five (5) years from the date of Substantial Performance.

## Part 2 Products

### 2.1 PERFORMANCE CRITERIA

- .1 Compatibility between the components of the roofing system is essential. All waterproofing materials are to be provided by the same manufacturer. Provide written declaration to Contract Administrator stating that materials and components, as assembled in system, meet this requirement.
  - .1 Roofing system: to CSA A123.21 for wind uplift resistance.

### 2.2 PRIMER

- .1 Primer for thermofusible membranes:
  - .1 Bitumen, fast-evaporating solvents and adhesive enhancing additives. It is required to prime most surfaces in order to improve the adhesion of heat welded waterproof membranes.
- .2 Primer for self-adhesive membranes:
  - .1 Composed of SBS synthetic rubber, volatile solvents, adhesive enhancing resins and volatile solvent used to prime porous substrates and non-porous substrates such as wood, concrete, or metal to enhance the adhesion of self-adhered membranes at temperatures above -10°C.
  - .2 Polymeric emulsion finish designed to improve adherence of self-adhesive waterproofing membranes when solvent-based primer is not recommended.

### 2.3 AIR VAPOUR BARRIER MEMBRANE

- .1 Thermofusible air/vapour barrier membrane:
  - .1 Description: thermofusible membrane composed of SBS modified bitumen and a nonwoven polyester reinforcement. Sanded top surface and the underside is covered with thermofusible plastic film.
  - .2 Properties:

|                                    | before heat conditioning |
|------------------------------------|--------------------------|
| .1 Strain energy min (MD/XD)       | 6.5/6.5 kN/m             |
| .2 Peak load min (MD/XD)           | 15/63 kN/M               |
| .3 Ultimate elongation min (MD/XD) | 55/70 %                  |
| .4 Dimensional stability (MD/XD)   | +/-0.5/0.1%              |
| .5 Thickness:                      | 3.0 mm (118 mils)        |
- .2 Self-adhered air/vapour barrier membrane:
  - .1 Description: Self-adhered membrane with SBS modified bitumen and a tri-laminated woven polyethylene facer. The underface is covered with silicone release film.
  - .2 Properties:

|                              |                            |
|------------------------------|----------------------------|
| .1 Tensile strength, MD/XD   | 9.5/13 kN/m (54/74 lbf/in) |
| .2 Ultimate elongation MD/XD | 33/25 %                    |
| .3 Static Puncture           | 400 N (90 lbf)             |
| .4 Tear resistance, MD/XD    | 423/458 N (95/103 lbf)     |

- .5 Thickness: 0.8 mm (31 mils)
- .3 Thermofusible slip sheet membrane:
  - .1 Description: thermofusible membrane composed of SBS modified bitumen and a nonwoven polyester 180/100gram reinforcement.
- .4 Continuity (transition/flashing) membrane:
  - .1 Description: Self-adhered transition membrane with SBS modified bitumen and a tri-laminated woven polyethylene facer. The underside is covered with silicone film.

## 2.4 INSULATION

- .1 Tapered (Sloped) Insulation and Backslope:
  - .1 Closed-cell polyisocyanurate foam insulation conforming to CAN/ULC-S701-01. Sloped as required to achieve general profile indicated on drawings. Minimum slope of 1% to roof drains and/or scuppers, as well as around perimeter and all penetrations.
  - .2 Below primary roof polyisocyanurate insulation boards.
- .2 Polyisocyanurate Insulation Type II:
  - .1 Closed-cell polyisocyanurate foam core integrally laminated between two heavy coated-glass facers. These facers shall be saturated with a coating that provides a smooth, consistent surface, free of loose fibres. Insulation thickness and layers as indicated on project drawings.

## 2.5 MEMBRANE ROOFING SYSTEM

- .1 SBS Base Sheet Membrane for field surfaces (Semi-Adhered):
  - .1 Description: Roofing membrane composed of SBS modified bitumen and a glass mat reinforcement. The surface is covered with thermofusible plastic film, the underside is covered with a release protection film. The surface must be marked with three (3) chalk lines to ensure proper roll alignment.
  - .2 Properties: Based on before heat condition, at 23C +/- 2 C
    - .1 Strain energy, min MD/XD 1/1 kN/m (5.7 / 5.7 lbf/in)
    - .2 Peak Load, min MD/XD 12/13.5 kN/m (69/77 lbf/in)
    - .3 Elongation at Peak Load, min MD/XD 6/7 %
    - .4 Ultimate Elongation, MD/XD 30/35 %
    - .5 Dimensional stability, max MD/XD +/-0.3 / +/-0.1 %
- .2 SBS Base Sheet Membrane for Flashing and Upstands:
  - .1 Description: Roofing membrane composed of SBS modified bitumen and a glass mat reinforcement. Top surface covered with a thermofusible plastic film, and the underside is covered with a release protection film. The surface must be marked with three (3) chalk lines to ensure proper roll alignment.
  - .2 Properties: Based on before heat condition, at 23°C +/- 2°C
    - .1 Strain energy, min MD/XD 1/1 kN/m (5.7 / 5.7 lbf/in)
    - .2 Peak Load, min MD/XD 12/13.5 kN/m (69/77 lbf/in)
    - .3 Elongation at Peak Load, min MD/XD 6/7 %
    - .4 Ultimate Elongation, MD/XD 30/35 %
    - .5 Dimensional stability, max MD/XD +/-0.3 / +/-0.1% SBS
- .3 SBS Traffic Cap Sheet Membrane for Field Surface (heat-welded):
  - .1 Description: Roofing membrane composed of SBS modified bitumen with a composite reinforcement and elastomeric bitumen. The surface is protected by coloured granules. The underface is covered with thermofusible film.

- .1 Top / Bottom Surfaces:
  - .1 Coloured Granules / protection film.
- .2 Properties: Based on before heat condition, at 23C +/- 2 C
  - .1 Strain energy, min MD/XD 7.3/6.5 kN/m (42 / 37 lbf/in)
  - .2 Peak Load, min MD/XD 17/12.5 kN/m (97/71 lbf/in)
  - .3 Elongation at Peak Load, min MD/XD 55/60%
  - .4 Ultimate Elongation, MD/XD 30/95%
  - .5 Dimensional stability, max MD/XD +/-0.6 / +/-0.1%
  - .6 Colour of cap sheet: as selected by the Contract Administrator.
- .4 SBS Traffic Cap Sheet Membrane for Flashings and Upstands:
  - .1 Description: Roofing membrane composed of SBS modified bitumen with a composite reinforcement and elastomeric bitumen. The surface is protected by coloured granules. The underface is covered with thermofusible film.
    - .1 Top / Bottom Surfaces:
      - .1 Coloured Granules / protection film.
    - .2 Properties: Based on before heat condition, at 23C +/- 2 C
      - .1 Strain energy, min MD/XD 7/3/6.5 kN/m (42 / 37 lbf/in)
      - .2 Peak Load, min MD/XD 17/12.5 kN/m (97/71 lbf/in)
      - .3 Elongation at Peak Load, min MD/XD 55/60%
      - .4 Ultimate Elongation, MD/XD 30/95%
      - .5 Dimensional stability, max MD/XD +/-0.6 / +/-0.1%
      - .6 Colour of cap sheet: as selected by the Contract administrator.

## **2.6 COVER STRIP BASE MEMBRANE**

- .1 SBS Membrane strip of 330 mm x 240 mm made of SBS modified bitumen with a composite reinforcement. The self-adhesive underface is covered by a thermofusible film and the surface is thermofusible. The strip ensures water tightness in the end laps.

## **2.7 FLAME-STOP MEMBRANE**

- .1 Self-adhered membrane composed of a reinforced glass mat and SBS modified bitumen designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes.

## **2.8 ADHESIVES**

- .1 Insulation adhesive:
  - .1 Description: A highly elastomeric, two-component urethane, one step, all purpose, foam able adhesive that contains no Volatile Organic Compounds (VOC) and sets in minutes.

## **2.9 FASTENERS IF APPLICABLE**

- .1 Philips pre-assembled hot-dipped galvanized #12-#14 mechanical fasteners made case-hardened carbon steel that comply with FMR approval standards, complete with 51 (2") diameter barbed stress plates that comply with the CSA B35.3.
  - .1 Or approved equal in accordance with B7 - Substitutes.

## **2.10 SEALERS**

- .1 Waterproofing mastic:
  - .1 Aluminized SBS mastic applied to finished membrane edges at perimeter metal edges, vent pipes and penetration pockets.

- .2 Premanufactured assembly, and pitch pocket filler:
  - .1 Pitch pocket system made of pre-cast curb components, including pourable sealant and structural adhesive/sealant.
- .3 Sealing product:
  - .1 Bitumen/polyurethane waterproofing mono-component resin and polyester reinforcement.
- .4 Supports for Roof Piping:
  - .1 C-Series channel supports for roof mechanical/electrical piping/conduits supports made of 100% recycled rubber, UV resistant with 14ga galvanized channel strut. Minimum 125 mm (5") high.

## **2.11 ROOF DRAINS**

- .1 Refer to mechanical.

## **2.12 EXHAUST VENT FLASHING**

- .1 Aluminum pre-manufactured insulated double wall metal flashing sleeve with deck flange, c/w matching metal hood slotted collar, (screw fastened).
- .2 Size: 102mm (4 inch) x 305mm (12 inch) high.

## **2.13 STACK FLASHING**

- .1 Aluminum pre-manufactured insulated stack flashing consisting of a metal flashing sleeve with integral flange, matching removable cap, pre-molded urethane insulation liner and EPDM Base Seal.
- .2 Minimum 300mm high.

## **Part 3 Execution**

### **3.1 QUALITY OF WORK**

- .1 Do examination, preparation, and roofing Work in accordance with the roofing manufacturer's specification manual and CRCA Roofing Specification Manual, particularly for fire safety precautions.
- .2 Do not install roofing materials during rain or snowfall.

### **3.2 SURFACE EXAMINATION**

- .1 Examine substrate surface in accordance with manufacturer's written instructions.
- .2 Confirm existing substrate surfaces are acceptable to manufacturer's written instructions to accept the Work of this section.
- .3 Contractor to profile level all existing surfaces receiving new roofing systems to ensure positive drainage will be achieved.
- .4 Notify the Contract Administrator in writing of discrepancies. Commencement of the Work or any parts thereof constitute acceptance of substrate conditions.

### **3.3 PREPARATION**

- .1 Protection:
  - .1 Protect adjacent surfaces and building finishes from damage resulting from the Work of this section.
  - .2 Protect finished Work to avoid damage during roof installation and material transportation. Install protective boardwalks over installed roofing materials to

- enable passage of people and products. Assume full responsibility for any damage.
- .3 Protect installation from moisture for minimum 48 hours after completion of each portion of Work.
- .4 Ensure Site protection below deck is provided at all times. Any contamination from construction processes and/or precipitation must not be permitted to penetrate the areas below the roof deck. Complete environmental separation must be maintained at all times.
- .2 Surface preparation:
  - .1 Ensure environmental and Site conditions are suitable as directed by manufacturer for installation of system.
  - .2 Remove all existing roofing materials, included membrane residual on existing roof deck. All loose and/or protruding materials to be removed down to existing roof deck with methods suitable to the contractor. The Contractor is to provide the applicable Site protection measures as necessary.
  - .3 Prepare surfaces in accordance with manufacturer's written instructions.

### **3.4 METHOD OF INSTALLATION**

- .1 Pre-conditioning of membranes:
  - .1 All types of membranes must be fully unrolled 15 minutes prior to installation, regardless of the temperature. For installation of membranes in cold weather refer strictly to manufacture's written specifications and recommendations.
  - .2 When installing self-adhered base sheet membranes in winter conditions, it is advisable to install the cap sheet membrane on the same day as the base sheet.

### **3.5 APPLICATION OF PRIMER**

- .1 Apply primer to wood, metal, concrete, masonry, gypsum board and cementitious board roofing substrates at a rate recommended by manufacturer. All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Cover primed surfaces with roofing membrane as recommend by manufacturer.

### **3.6 INSTALLATION OF THERMOFUSIBLE AIR VAPOUR BARRIER MEMBRANE**

- .1 Primer must be dry prior to the installation of the air vapour barrier membrane.
- .2 Starting at the lowest point of the roof slope, the air vapour barrier membrane must be heat-welded onto the substrate in conformance with manufacturer's written instructions.
- .3 Overlap adjacent rolls by 75 mm (3 inches) and 100 mm (4 inches). End laps must be 150 mm (6 inches). Space end laps by at least 300 mm (12 inches).
- .4 The roof air vapour barrier must meet and overlap the air vapour barrier on adjoining walls to ensure total continuity.
- .5 Pull up air vapour barrier at insulation perimeters and around each element penetrating it to ensure sealed connections with flashing base sheet.

### **3.7 INSTALLATION OF SELF-ADHERED AIR VAPOUR BARRIER MEMBRANE**

- .1 Primer must be dry prior installation of the vapour barrier membrane.
- .2 Beginning at the bottom of the slope, without adhering the membrane, unroll onto the substrate for alignment. Do not immediately remove the silicone release sheet.
- .3 Align the roll parallel to the corrugations of the steel deck. Make sure the membrane overlaps are supported along their entire length.

- .4 Peel back one end of the silicone release sheet and adhere this part of the membrane to the substrate. Peel back the remaining release sheet at a 45 degree angle to avoid wrinkles in the membrane.
- .5 Overlap adjacent membranes by 75 mm (3 in). Overlap end laps by 150 mm (6 in). Stagger end laps by at least 300 mm (12 in).
- .6 When the vapour barrier is installed directly on the steel deck, place a thin sheet of metal under the end lap of the vapour barrier.

### **3.8 INSTALLATION OF INSULATION**

- .1 Tapered insulation and backslope:
  - .1 Adhere insulation to air vapour barrier panel or to adjoining board using specified adhesive.
  - .2 Apply adhesive in 19 mm (3/4") continuous parallel ribbons at 300 mm (12") on center (each layer). Refer manufacturer's written instructions for spacing at perimeters and corners to meet wind uplift requirements.
  - .3 Install tapered insulation as first insulation layer, in accordance with shop drawings. Stagger joints between layers 150 mm (6") minimum.
  - .4 Follow the other installation instructions as listed below.
- .2 Insulation:
  - .1 Adhere insulation to tapered insulation, air vapour barrier panel and to adjoining board using specified adhesive.
  - .2 Apply adhesive in 19 mm (3/4") continuous parallel ribbons at 300 mm (12") on center (each layer). Refer manufacturer's written instructions for spacing at perimeters and corners to meet specified uplift requirements.
  - .3 Use largest insulation sheets as possible, place boards in parallel rows with ends staggered, and in firm contact with one another.
  - .4 All vertical joints between level boards and sloped modules for the two rows of insulation board to be staggered a minimum of 150 mm (6").
  - .5 Use a weighted roller to ensure continuous contact between insulation, adhesive and air/vapour barrier panel.
  - .6 At gaps in the insulation, cut and adhere segments of rigid insulation as required to ensure full continuity in thermal barrier.
  - .7 If localized mechanical anchors are required to secure insulation due to surface irregularities, they shall be included in the fixed price of the roof installation and the fasteners shall be hot-dipped galvanized No. 14 screws. Dip screws in liquid membrane prior to insertion to provide air seal.
  - .8 Install only as much insulation as can be covered in the same day.

### **3.9 INSTALLATION OF FLAME-STOP MEMBRANES**

- .1 Adhere the membrane directly onto an approved substrate by peeling back the silicone release film. Membrane tape is designed to prevent flames from penetrating into empty spaces and openings while installing heat-welded membranes.
- .2 Unroll the flame-stop membrane onto the insulation without adhering, being careful to overlap adjacent strips to ensure that the flame will not meet the insulation.

### **3.10 INSTALLATION OF SELF-ADHERED BASE SHEET**

- .1 Beginning at the drains and perpendicular to the slope, install the base sheet membrane without adhering in parallel strips.
- .2 Each strip should overlap the preceding strip by 75mm (3 inches). along the side joint (use the blue line to facilitate alignment) and by 25mm at the ends. Base sheet

membrane joints can be aligned (no staggering) to facilitate the installation of the reinforcing band.

- .3 Let the membrane relax at least 15 minutes before installing it, burn the plastic film in a zig-zag fashion using a propane torch to relax it. In cold weather, use the zig zag method.
- .4 Peel back the silicone release paper to adhere the membrane to the substrate. Use a weighted roller to apply even pressure and to ensure good adherence.
- .5 Remove the paper protecting the selvedge then heat the side joints. Seal the joints using a trowel. A bead of molten bitumen should appear along the joint to ensure a perfect seal.
- .6 Seal the end joints by welding a 300 mm (12") wide protection band centred on the joint.
- .7 Avoid creating wrinkles, blisters, and fishmouths.
- .8 The base sheet membrane should end over the edge of the substrate.

### **3.11 BASE SHEET FLASHING INSTALLATION (SELF ADHERED)**

- .1 Apply base sheet flashing only after primer coat is dry.
- .2 Before applying membranes, always remove the plastic film on the section to be covered if there is an overlap (inside and outside corners and field surface). For sanded base sheet membranes, apply primer to the area to be covered at the foot of the parapets.
- .3 Position the pre-cut membrane piece. Peel back 100 mm (4") to 150 mm (6") of the silicone release paper to hold the membrane in place at the top of the parapet.
- .4 Then, gradually peel back the remaining silicone release paper, pressing down on the membrane with an aluminum applicator to ensure good adhesion. Use the aluminum applicator to ensure a perfect transition between the upstand and the field surface. Smooth the entire membrane surface with a roller for full adhesion.
- .5 Cut off corners at end laps to be covered by the next roll.
- .6 Install a reinforcing gusset in all inside and outside corners.
- .7 Always seal overlaps at the end of the workday.

### **3.12 INSTALLATION OF REINFORCEMENTS**

- .1 Install reinforcements specified for various roof surfaces according to the following instructions and illustrations found in manufacturer's technical data.

### **3.13 CAP SHEET INSTALLATION (HEAT-WELDED MEMBRANE)**

- .1 Once base sheet is applied and no defects are apparent, proceed with cap sheet installation.
- .2 Begin with double-selvage starter roll. If starter roll is not used, side laps covered in granules must be degranulated by embedding side laps in torch-heated bitumen over a 100 mm (4 inch) width.
- .3 Unroll cap sheet at drain. Carefully align first side lap (parallel to roof edge).
- .4 Weld cap sheet onto base sheet with torch recommended by membrane manufacturer. During application, simultaneously melt both designated contact surfaces so a bead of bitumen is apparent as cap sheet unrolls.
- .5 Avoid overheating.
- .6 Make sure joints between the two layers are staggered by at least 300 mm (12 inches).
- .7 Overlap cap sheet side laps by 100 mm (4 inches) and end laps by 150 mm (6 inches). Cut off corners at end laps to be covered by next roll. All overlap surfaces must be degranulated.

- .8 Complete perfect welds between two membranes. Leave no zone unwelded. In cold weather, adjust welding time to obtain homogenous seam (it may be necessary to slow down in certain cases).
- .9 Application to be free of blisters, fishmouths and wrinkles.
- .10 Once cap sheet is installed, carefully check all overlapped joints.
- .11 During installation, take care to avoid excessive bitumen bleed-out at joints.

### **3.14 INSTALLATION OF CAP SHEETS ON UPSTANDS AND PARAPETS (HEAT-WELDED)**

- .1 This cap sheet must be installed in one-metre-wide strips. The side joints must overlap by 100 mm (4 inches) and must be staggered by at least 100 mm (4 inches) with respect to the joints of the cap sheet on the field surface, to avoid areas of excessive membrane thickness. The overlaps on the field surface must be 50 mm (2 inches) wider than those of the base sheet membrane on the upstands and parapets. At end laps, angle-cut the corners that will be covered by the following roll.
- .2 Use a chalk line to draw a straight line on the field surface 150 mm (6 inches) from the upstands and parapets.
- .3 Use a propane torch and round-nose trowel to embed the surface granules in the layer of hot bitumen starting from the chalk line on the field surface to the bottom edge of the upstand or parapet as well as on the granulated vertical surfaces that are to be overlapped.
- .4 This cap sheet will be heat-welded directly to the base sheet membrane, proceeding from bottom to top. This technique softens both membranes in order to obtain even, continuous weld.
- .5 During installation, be careful not to overheat the membrane or to create excessive bitumen bleeding at the joints.

### **3.15 ROOF PENETRATIONS**

- .1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

### **3.16 WATERPROOFING FOR VARIOUS DETAILS**

- .1 Install waterproofing membranes in conformance with various roofing details and as per manufacturer's written technical documentation.

### **3.17 FIELD QUALITY CONTROL**

- .1 Field reviews:
  - .1 Field reviews of roofing application will be carried out by the Contract Administrator and/or by independent inspection agency designated by the Contract Administrator.
- .2 Manufacturer field reviews:
  - .1 Schedule field reviews by the manufacturer representative as follows:
    - .1 During mick-up.
    - .2 Periodically during roof replacement.

### **3.18 CLEANING**

- .1 Remove bituminous markings from finished surfaces.
- .2 In areas where finished surfaces are soiled due to Work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.
- .3 Repair or replace defaced or disfigured finishes caused by Work of this section.



**END OF SECTION**

## **Part 1            General**

### **1.1                REFERENCES**

- .1 American Society for Testing and Materials International (ASTM):
  - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A792/A792M-08, Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - .3 ASTM C920-05, Standard Specification for Elastomeric Joint Sealants.
  - .4 ASTM D523-14 (2018), Standard Test Method for Specular Gloss.
  - .5 ASTM D822/D822M – 13 (2018), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
  - .6 ASTM D2244-22 Standard Practice for Calculation of Colour Tolerances and Colour Differences from Instrumentally Measured Colour Coordinates.
  - .7 ASTM D2247-15 (2020) Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
- .2 Canadian Roofing Contractors Association (CRCA):
  - .1 Roofing Specifications Manual.

### **1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Samples:
  - .1 Submit duplicate 100 mm x 100 mm (4"x4") samples of each type of sheet metal material, finishes and colours.
- .4 Quality assurance submittals:
  - .1 Manufacturer's instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.
- .5 Closeout Submittals:
  - .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
  - .2 Submit operation and maintenance data for incorporation into the manual, including manufacturer's recommended cleaning instructions for metal components.
  - .3 Submit manufacturers and contractor's warranty documentation.

### **1.3                PRE-INSTALLATION MEETING**

- .1 In accordance with Section 01 31 19 – Project Meetings.
- .2 Convene a pre-installation meeting one week prior to beginning work of this section and on-site installation, with Contractor's representative, and Contract Administrator to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Stack flashings to prevent twisting or bending out of shape.
- .3 Prevent contact of flashing materials with corrosive substances.
- .4 Damaged materials shall be rejected and replaced with new materials.
- .5 Handle and store metal flashings so that marring and scratching of the coatings do not occur.

#### **1.5 WARRANTY**

- .1 Warranty for flashing assembly to be free of the following defects: splitting seams, lifting, loosening and undue expansion for two (2) years from date of Substantial Performance.

### **Part 2 Products**

#### **2.1 SHEET METAL MATERIALS**

- .1 Zinc coated steel sheet: thickness as shown on drawings, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
- .2 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality.

#### **2.2 PREFINISHED STEEL SHEET**

- .1 Prefinished steel with factory applied silicone modified polyester.
  - .1 Thickness: minimum 0.61 mm (24 gauge) or as otherwise indicated on drawings and details.
  - .2 Colour: selected by the City from manufacturer's standard range to match existing.
  - .3 Specular gloss: 30 units +/- 5 in accordance with ASTM D523.
  - .4 Coating thickness: not less than 25 micrometres.
  - .5 Resistance to accelerated weathering for chalk rating of 8 in accordance with ASTM D822/D822M.
  - .6 Resistance to colour fade 5 units or less in accordance with ASTM D2244.
  - .7 Resistance to humidity after 1000 hours of exposure in accordance with ASTM D2247.

#### **2.3 ACCESSORIES**

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Sealants:
  - .1 Silicone sealant: Single component, neutral cure, silicone sealant to ASTM C920, Type S, Grade NS, Class 50/50, Use NT, M, A, G, and O.
  - .2 Colour: By the City based on manufacturer standard colour range.
  - .3 Acceptable product:
    - .1 Dowsil 795.
    - .2 Or approved equal in accordance with B7 - Substitutes.
- .3 Cleats: of the same materials as the metal designed to secure. Size shall be to suit components to be secured (minimum 100 mm wide). Gauge shall be sufficient to retain the flashings in place.
- .4 Straps: same material, and temper as sheet metal, minimum 50 mm (2") wide, thickness same as sheet metal being secured.

- .5 Fasteners: as indicated on drawings.
- .6 Washers: as indicated on drawings.
- .7 Touch-up paint: as recommended by prefinished material manufacturer.

## **2.4 FABRICATION**

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated on drawings.
- .2 Form pieces in 3050 mm (10'-0") maximum lengths.
  - .1 Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm (½").
  - .1 Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coatings to metal surfaces to be embedded or in contact with concrete or mortar.

## **2.5 METAL FLASHINGS**

- .1 Form flashings, trims, copings, and fascia's, etc. to profiles and thicknesses indicated on drawings.
- .2 Butt end joints and provide 150 mm (6") backup plates or provide tight fit S-lock.
- .3 Each cap flashing to incorporate a 45 degree, 12 mm (½") hemmed drip edge, unless otherwise noted on drawings.

## **2.6 STEEL GUTTER**

- .1 Steel Coil Stock:
  - .1 Box gutter fabrication.
  - .2 Gutter size 125 mm (5"), continuous.
  - .3 Gutter corner fabrication. Corners shall extend a minimum of 300 mm (12") from each corner in each direction. Lap joints and sealant where connecting continuous gutter. Match material, shape, and finish of gutter.
  - .4 Fabricated from Z275 galvanized sheet steel conforming to ASTM A653M Grade 230 or AZ150 Galvalume, sheet steel conforming to ASTM A792M Grade 230 and having a nominal core thickness of 22 gauge.
  - .5 Fasteners: Stainless steel, with exposed fasteners colour matched to cladding.
  - .6 Gutter coating: pre-painted.
  - .7 Colour: Pre-finished cladding colour on exterior exposed surface as selected by the Contract Administrator from the manufacturer's standard colour range to match existing.

## **2.7 DOWNSPOUTS (RAINWATER LEADERS)**

- .1 Form downspouts from prefinished steel sheet metal.
- .2 Thickness: 24 Ga.
- .3 Downspouts shall not be corrugated.
- .4 Downspouts to be closed over first top 762 mm (30"), remainder to be open 'C' shape.
- .5 Provide drain extensions minimum 150 mm (6") along base of building to ensure water is carried onto splash pad and away from the building foundation and walls.
- .6 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

- .7 Precast concrete splash pads:
  - .1 Concrete pad:
    - .1 Precast concrete pad manufactured at a precast concrete facility in accordance with CSA A23.4.
    - .2 Size: 305 mm wide x 762 mm long x 80 mm high.
  - .2 Approved product:
    - .1 760 mm (30") Natural Splash Pad, Item No. 141474 manufactured by Barkman Concrete.
    - .2 Or approved equal in accordance with B7 - Substitutes.

## **2.8 SCUPPERS**

- .1 Form scuppers, including hopper box, from prefinished steel to profiles and thicknesses indicated on drawings.
- .2 Scupper size as indicated on drawings.
- .3 Provide necessary fastenings and sealant.

## **2.9 REGLETS**

- .1 Form recessed and surface mounted reglets to profiles and thicknesses indicated on drawings, to be built-in concrete or masonry work in accordance with CRCA FL series details and as indicated on drawings.
  - .1 Provide slotted fixing holes and neoprene/steel/plastic washer fasteners.

## **Part 3 Execution**

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

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

### **3.2 EXAMINATION**

- .1 Examine substrate surface in accordance with manufacturer's direction and written instruction.
- .2 Confirm existing substrate surfaces are acceptable to manufacturer's directions and written instructions to accept Work of this section.
- .3 Notify Contract Administrator in writing of discrepancies. Commencement of the Work or any parts thereof constitute acceptance of substrate conditions.

### **3.3 INSTALLATION**

- .1 Install sheet metal work in accordance with CRCA FL series details and as indicated on drawings.
- .2 Use concealed fastenings, unless otherwise indicated on drawings and where approved before installation.
- .3 Counter flash bituminous flashings at intersections of roof with vertical surfaces and curbs.
- .4 Flash joints using S-lock forming tight fit over hook strips or butt end joints with a 150 mm (6") backup plate.
- .5 Lock end joints and caulk with sealant.
- .6 Install surface mounted relets true and level, and caulk top of reglet with sealant.

- .7 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm (1"). Lead wedge flashing securely into joint and caulk top with sealant.
- .8 Any through wall flashing shall be installed on 10-degree slope unless noted otherwise.
- .9 Install pans, where shown around items projecting through roof membrane.

### **3.4 GUTTER**

- .1 Install gutter supports at no more than 600 mm (24") on center.
- .2 Slope gutters evenly to downspouts; provide end caps and seal watertight as per manufacturer's instructions.
- .3 Install outlet tubes at all downspouts locations and seal watertight.
- .4 Apply joint sealant at gutter joints as per manufacturer's installation instructions.

### **3.5 DOWNSPOUTS (RAINWATER LEADERS)**

- .1 Install downpipes and provide goosenecks back to wall.
  - .1 Secure downpipes to wall with straps at 1200 mm (48") on centre; minimum two straps per downpipe.
  - .2 Provide minimum 150 mm (6") drain extensions out from base of building.
- .2 Install splash pads at downpipe locations:
  - .1 Provide minimum 50 mm (2") granular fill to support splash pads.
  - .2 Ensure splash pads are positioned to provide positive drainage and slope away from building foundation and walls.

### **3.6 FLASHING**

- .1 Install starter flashing, drip and other flashing, corners, edgings as required and shown on the drawings.

### **3.7 SCUPPERS**

- .1 Install scuppers as indicated and at locations shown on drawings.

### **3.8 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by flashing installation.

### **3.9 CLEANING**

- .1 Proceed in accordance with Section 01 74 00 – Cleaning and Waste Management.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.
- .3 Leave work areas clean, free from grease, finger marks and stains.

**END OF SECTION**

## **Part 1 General**

### **1.1 RELATED SECTIONS**

- .1 Work to include all labour, material and equipment required for installing, testing and placing in initial operation the following systems as detailed in specifications of each section and as shown on drawings.
  - .1 Section 22 07 00 – Plumbing Insulation
  - .2 Section 22 11 23 – Facility Natural Gas Piping
  - .3 Section 22 13 17 – Drainage Waste and Vent Piping – Cast Iron and Copper
  - .4 Section 22 13 18 – Drainage Waste and Vent Piping – Plastic.
  - .5 Section 22 42 01 – Plumbing Specialties and Accessories
  - .6 Section 23 00 01 - Common Work Results for HVAC

### **1.2 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Shop drawings to show:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .2 Shop drawings and product data accompanied by:
    - .1 Detailed drawings of bases, supports, and anchor bolts.
    - .2 Manufacturer to certify current model production.
    - .3 Certification of compliance to applicable codes.
- .3 Co-ordination drawings:
  - .1 Submit co-ordination drawings as specified in this section.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual to be reviewed by the Contract Administrator, and final copies deposited with the City's Representative prior to final inspection. Final payment will not be made until all required manuals have been received by the City.
- .3 Review instructions with the City's representative to ensure the City's representative has a thorough understanding of equipment and its operation.
- .4 Operation data to include:
  - .1 Description of systems
  - .2 Operation instruction for systems and component.
  - .3 Description of actions to be taken in event of equipment failure.
  - .4 Colour coding chart.
- .5 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Provide list of spare and replacement parts and names and addresses of suppliers.
  - .3 All specified spare parts are to be turned over to the City.

- .6 Performance data to include:
  - .1 Special performance data as specified.
- .7 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to the Contract Administrator for review. Submission of individual data will not be accepted unless directed by the Contract Administrator.
  - .2 Make changes as required and re-submit as directed by the Contract Administrator.
- .8 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .9 Site records:
  - .1 Mark changes as work progresses and as changes occur to record set of drawings. Include changes to existing mechanical systems and new mechanical and plumbing systems.
  - .2 Update record drawings on a weekly basis to ensure they are accurate, and have available for reference and inspection at all times.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
  - .5 This information will be used to produce As-Built drawings.
- .10 As-built drawings:
  - .1 Refer to section 01 78 00 – Closeout Submittals
- .11 Submit copies of as-built drawings for inclusion in final TAB report.

**1.4 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 40 00 - Quality Requirements.

**1.5 MAINTENANCE**

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Construction Waste Management and Disposal: in accordance with Section 01 74 00 - Cleaning and Waste Management.

**1.7 REQUEST FOR INFORMATION PROCESS**

- .1 Refer to Section 01 33 00 - Submittal Procedures.

**1.8 CO-ORDINATION WITH OTHER DIVISIONS, TRADES, AND CONTRACTORS**

- .1 Divisions 22 and 23 shall ensure that they read this specification and the associated drawings in conjunction with the following:
  - .1 The Division 01 specifications
  - .2 The building (architectural) drawings and specifications.
  - .3 The Structural drawings and specifications.
  - .4 The Phasing Drawings produced by the Contractor..



- .2 Divisions 22 and 23 are responsible for co-ordination of their work with all other trades and Subcontractors, including those listed above, through the prime Contractor. Working through the Contractor, these divisions are responsible for ensuring that the installation of their work is co-ordinated with all other trades and subcontractors to mitigate interference issues between these trades and Subcontractors on site.
- .3 Subcontractors engaged for work in divisions 22 and 23 shall attend regular co-ordination meetings including pre-installation conferences with the Contractor and other relevant parties..

## **1.9 COORDINATION DRAWINGS**

- .1 Prepare interference and coordination drawings for all areas, wherever there is possible conflict and/or obstruction due to the positioning of mechanical equipment, piping, wiring, ductwork, or other work of this division relative to other trades.
- .2 Prepare drawings in conjunction with other trades
- .3 Show all sleeves and openings for passage through structure, and all inserts, equipment bases, sumps, pits and supports, and relate these to suitable grid lines and elevation datum.
- .4 Submit drawings for review by the Contract Administrator.
- .5 Drawings shall be to a scale sufficient to show the necessary details. Submit to the the Contract Administrator for review and distribute drawings after review to trades concerned.
- .6 Prepare fully dimensioned detail drawings of shafts, duct spaces, pipe spaces and tunnels. Show holes and sleeves, and include information pertaining to access, clearances, tappings, drains and electrical connections.
- .7 Base information used to prepare drawings on certified shop drawings.
- .8 Prepare, and submit for review, scale drawings of equipment bases, anchors and their relationship to structure, inertia slabs, floor and roof curbs, which pertain to divisions 22 and 23 work and which are not shown on the building Drawings.

## **1.10 GUARANTEE**

- .1 Guarantee satisfactory operation of all work and apparatus installed under this contract. Replace, at no expense to the City, all items which fail or prove defective within a period of one year after final acceptance of complete contract by the City, always provided such failure is not due to improper usage by the City. Make good all damage to building incurred as a result of failure or repair of mechanical work.
- .2 No certification given, payment made, partial or entire use of equipment by the City, shall be construed as acceptance of defective work or acceptance of improper materials. Make good at once, without cost to the City all such defective work or materials and consequence resulting there from, within one year of final acceptance date.
- .3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

## **1.11 IDENTIFICATION OF VALVES, PIPES AND EQUIPMENT**

- .1 In accordance with Section – 23 05 54 – Mechanical Identification

- .2 Provide access doors for concealed valves or groups of valves, flush valves, shock arrestors, trap seal primers, etc.

## 1.12 OPENINGS IN FIRE SEPARATIONS

- .1 Provide firestopping for all openings in fire separations for passage of pipes, ducts, etc. to maintain integrity of fire separations.
- .2 Installer qualifications
  - .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer.
  - .2 The work is to be installed by a contractor with at least one of the following qualifications:
    - .1 FM 4991 Approved Contractor
    - .2 UL Approved Contractor
    - .3 Manufacturer Accredited Fire Stop Specialty Contractor
  - .3 Firestop installer shall have not less than five (5) years' experience with fire stop installation.
  - .4 Firestop Performance requirements
    - .1 Firestopping Materials: ULC to achieve a fire rating as noted on Drawings.
    - .2 Firestop all interruptions to fire rated assemblies, materials, and components.
    - .3 Firestopping and smoke seal systems in accordance with CAN/ULC S115.
  - .5 Quality assurance
    - .1 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
    - .2 Firestop system installation must meet requirements of CAN/ULC-S115-11 or UL 2079 tested assemblies.
    - .3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
    - .4 Firestop systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
    - .5 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.
  - .6 Firestopping
    - .1 Approved manufacturers
      - .1 Hilti
      - .2 3M
      - .3 Tremco Inc.

- .4 A/D Fire Protection Systems Inc.
- .2 All fire stop products to be installed in accordance with manufacturers recommendations for the specific material, substrate and opening size.

### **1.13 TEMPORARY USE OF EQUIPMENT**

- .1 Permanent systems and/or equipment not to be used during construction period, without the Contract Administrator's written permission.
- .2 Equipment used during construction period to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of the Contract Administrator and the City.
- .3 Provide proper care, attention and maintenance for equipment while it is being used. If, in opinion of the Contract Administrator, sufficient care and maintenance is not being given to equipment and systems, the Contract Administrator reserves right to forbid further use of said equipment and systems.
- .4 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment so used this guarantee period to commence as of date of final acceptance of building by the City as interpreted by the Contract Administrator.

### **Part 2 Products**

Not used.

### **Part 3 Execution**

#### **3.1 CLEANING**

- .1 On completion, each piping system shall be flushed out before installation of equipment, fixtures, etc. in order to remove any foreign material in piping.
- .2 Flush with water, unless noted otherwise in individual mechanical sections of specifications.
- .3 All plumbing fixtures and all equipment shall be thoroughly cleaned and left in first class operating condition.

#### **3.2 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests and submit report as described in PART 1 - SUBMITTALS.
  - .1 Pressure test as indicated by CSA B149.1 – Natural gas and Propane Installation Code
- .2 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .2 Schedule site visits, to review Work, as directed in Section 01 40 00

### 3.3 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

### 3.4 GENERAL PLUMBING PIPING INSTALLATION

- .1 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.
- .2 Connect to fixtures/equipment/accessories and install in accordance with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .3 Do not bury copper pipe except where specifically noted on drawings.
- .4 Cut all pipe accurately to measurements taken at site, installed without springing or forcing. All changes in direction made with fittings.
- .5 Affix applicable labels c/w directional arrows to match existing.
- .6 Remove valve working parts during installation to prevent damage from heat where brazing or soldering is used.
- .7 Route all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.
- .8 Co-operate with all sub-trades to properly locate all equipment connections.
- .9 Comply with latest CSA Standard W117.2 "Code for Safety in Welding and Cutting".
- .10 When brazing or soldering protect adjacent surfaces from heat and flame.
- .11 Make threaded joints in steel piping in accordance with ASME B1.20.1. Apply approved non-toxic joint compound to male threads only. Do not apply joint compound to the first two threads. Avoid squeezing excess compound into pipes. Ream and file all pipes. Leave full bore, clean and free of scale.
- .12 Expansion and contraction of piping:
  - .1 Make provision for expansion and contraction of piping. Use swing connections where shown or necessary.
  - .2 Provide expansion loops for hot water supply and recirculation piping where required. Anchor with approved rigid anchors in order to control expansion.
  - .3 Provide expansion joints in accordance with manufacturers recommendations.
  - .4 Provide anchors and guides as recommended by the manufacturer.
- .13 Cleaning and flushing:
  - .1 Flush out piping systems before installation of equipment, fixtures, etc. in order to remove any foreign material in piping.
  - .2 Clean out plumbing fixtures.

### 3.5 DRAINAGE SYSTEMS INSTALLATION

- .1 General:
  - .1 Provide sisson joints:
    - .1 On all drain pipes routed into, or through, slab on grade to take up movement of slab.
    - .2 At base of all multi-story risers.
  - .2 Plastic piping:
    - .1 Do not use plastic piping in any shafts spaces.
    - .2 Do not use exposed plastic piping in any egress corridors or stairs. Installation within rated enclosures acceptable.

- .3 Use fire rated piping within return air plenums.
- .3 Cleanouts:
  - .1 Install cleanouts:
    - .1 At all changes of direction
    - .2 At intervals of not over 15m (50') in horizontal runs
    - .3 At all points where obstructions might be formed
    - .4 At base of soil/waste stacks and rainwater leaders
    - .5 At points required by plumbing regulations or shown on drawings.
  - .2 Provide chrome plate cap tight to wall for cleanouts on sink waste and vent pipes.
  - .3 Ensure cleanouts are accessible. Extend cleanouts to face of structure with access cover and frame where located above furred ceilings or in concrete slabs on grade.
  - .4 Provide access panel for cleanouts located behind walls. Co-operate in locating cleanouts adjacent to access panels, etc.
  - .5 Seal all metallic cleanout plugs with Teflon tape. Check all cleanouts are secured immediately prior to turning the job over to the City.
  - .6 Rough-in clean-out in conformance with manufacturer's installation instructions to ensure proper transition and tie-in to adjacent flooring material.
  - .7 Coordinate with other trades on site to apply finish to cleanout covers to ensure they will be flush with wall, floor surface, inconspicuous, and accessible.
- .4 Brace fittings where necessary to prevent joints coming apart under pressure.

### 3.6 TESTING

- .1 General:
  - .1 Perform operating tests to all systems and equipment in accordance with local regulations and manufacturer's instructions.
  - .2 Give 48 hours notice to the Contract Administrator in advance of all tests.
  - .3 Provide test report to the Contract Administrator.
  - .4 Include test reports in Operating and Maintenance Manuals
- .2 Plumbing drainage systems:
  - .1 Pressure test systems in accordance with local regulations.
  - .2 Ball test to verify grades and freedom from obstructions.
- .3 Natural gas piping systems:
  - .1 Pressure test systems in accordance with local regulations.

**END OF SECTION**

**Part 1            General**

**1.1            DESCRIPTION**

- .1        This section specifies the requirements for thermal insulation for piping and piping accessories in commercial type applications.

**1.2            REFERENCES**

- .1        American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1        ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2        American Society for Testing and Materials International (ASTM)
  - .1        ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2        ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3        ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4        ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5        ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
  - .6        ASTM C547-2003, Mineral Fiber Pipe Insulation.
  - .7        ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8        ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3        Canadian General Standards Board (CGSB)
  - .1        CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2        CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4        Manufacturer's Trade Associations
  - .1        Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .5        Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2        CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3        CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
  - .4        CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

**1.3            DEFINITIONS**

- .1        For purposes of this section:

- .1 "Concealed" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "Exposed" - will mean "not concealed" as specified.
- .2 TIAC:
  - .1 CPF: Code Piping Finish.

#### **1.4 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

#### **1.5 QUALITY ASSURANCE**

- .1 In accordance with Section 01 40 00 – Quality Requirements
- .2 Installer: specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

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

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
  - .1 Protect from weather, construction traffic.
  - .2 Protect against damage.
  - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
  - .1 Construction Waste Management and Disposal: in accordance with Section 01 74 00 - Cleaning and Waste Management.

### **Part 2 Products**

#### **2.1 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102.
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

#### **2.2 INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.

- .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
- .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to ASTM C533.
  - .2 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
  - .3 Design to permit periodic removal and re-installation.
- .5 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
  - .1 Insulation: with vapour retarder jacket.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: CAN/ULC-S702 ASTM C547.
  - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
- .7 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.

### **2.3 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

### **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

### **2.5 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.

### **2.6 INDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

### **2.7 JACKETS**

- .1 Polyvinyl Chloride (PVC) (indoor)



- .1 One-piece moulded type to CAN/CGSB-51.53 with pre-formed shapes as required.
- .2 Colours: to match adjacent finish paint.
- .3 Minimum service temperatures: -20 degrees C.
- .4 Maximum service temperature: 65 degrees C.
- .5 Moisture vapour transmission: 0.02 perm.
- .6 Fastenings:
  - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
  - .2 Tacks.
  - .3 Pressure sensitive vinyl tape of matching colour.
- .7 Special requirements:
  - .1 Indoor: None.
  - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 Aluminum Embossed (Outdoor)
  - .1 Cover insulation with aluminum jacket CSA HA Series - M1980.
  - .2 Embossed alloy jacketing 0.4 mm thick with longitudinal slip joints and 50 mm end laps with factory attached protective straps with mechanical fastener.
  - .3 Jackets on fittings, 0.4 mm thick, die shaped components of alloy with factory attached protective liner on interior surface.

### **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 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed, and certified prior to insulation being applied.
- .2 Surfaces clean, dry, free from foreign material.

#### **3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

**3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: at valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.
  - .2 Jacket: PVC.

**3.5 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: Tape at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
  - .1 Securements: Tape at 300 mm on centre.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 Thickness of insulation as listed in following table.
  - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
  - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings, unless required for protection of residence occupants and barrier free installation.

| Application                                                         | TIAC code | Pipe sizes (inch NPS) and insulation thickness (mm) |      |            |            |        |          |
|---------------------------------------------------------------------|-----------|-----------------------------------------------------|------|------------|------------|--------|----------|
|                                                                     |           | Run out                                             | to 1 | 1 1/4 to 2 | 2 1/2 to 4 | 5 to 6 | 8 & over |
| Sanitary Vent Terminations (6 feet back from exterior wall or roof) | A-3       | 25                                                  | 25   | 25         | 25         | 25     | 25       |
| Storm Drainage Piping (entire length)                               | A-3       | 25                                                  | 25   | 25         | 25         | 25     | 25       |

- .5 Finishes:
  - .1 Exposed indoors: PVC jacket.
  - .2 Exposed in mechanical rooms: PVC jacket.
  - .3 Concealed, indoors: canvas on valves, fittings. No further finish.
  - .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
  - .5 Outdoors: water-proof PVC jacket.
  - .6 Finish attachments: stainless steel screws bands, at 300 mm on centre. Seals: closed.

.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

**3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 00 - Cleaning and Waste Management.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies the materials and installation requirements for piping, valves and fittings for gas fired equipment.

**1.2 RELATED REQUIREMENTS**

- .1 Section 22 05 00 – Common Work Results for Plumbing

**1.3 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
  - .2 ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ASME B16.22-01, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
  - .4 ASME B18.2.1-96, Square and Hex Bolts and Screws Inch Series.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
  - .3 ASTM B75M-99, Standard Specification for Seamless Copper Tube [Metric].
  - .4 ASTM B83[01], Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
- .4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
  - .1 CAN/CSA B149.1HB-00, Natural Gas and Propane Installation Code Handbook.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Safety Data Sheets (SDS).

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
  - .2 Indicate on manufacturers catalogue literature following: valves.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## **1.5 QUALITY ASSURANCE**

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting with the Contract Administrator a minimum of one (1) week prior to beginning work of this Section.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Co-ordination with other building subtrades.
    - .4 Review manufacturer's installation instructions and warranty requirements.

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

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 00 - Cleaning and Waste Management.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal paper, plastic, corrugated cardboard packaging material in appropriate on-site bins for recycling.
  - .4 Separate for recycling and place in designated containers steel, metal and plastic waste
  - .5 Divert unused metal materials from landfill to metal recycling facility.

## **Part 2 Products**

### **2.1 PIPE**

- .1 Up to 150mm (6"): - Schedule 40 carbon steel, continuous weld or electric resistance weld pipe conforming to ASTM A53 Grade B.

### **2.2 JOINTING MATERIAL**

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: nonmetallic flat.
- .4 Brazing: to ASTM B837.

### **2.3 FITTINGS**

- .1 Up to 50mm (2"):
  - .1 Screwed fittings - 1034 kPa (150 psi) black malleable iron, banded.
  - .2 Socket weld fittings - 13,800 kPa (2000 psi) forged steel.
  - .3 Unions - 1034 kPa (150 psi) brass to iron seat.
  - .4 Thread-O-Lets and Weld-O-Lets to be manufactured to ASTM A181, Grade 1 or approved equivalent in accordance with B7.
- .2 64mm (2-1/2") and larger:
  - .1 Butt welding fittings to be Crane manufactured to ASTM A234, or approved equivalent in accordance with B7
  - .2 Flanges to be Anvil forged carbon slip-on welding flanges conforming to ASTM A181, Grade 1, or approved equivalent in accordance with B7.

- .1 Use ring gaskets on raised face flanges and full faced gaskets on flat faced flanges.
- .2 Use 1034 kPa (150 psi) flanges on systems to 689 kPa (100 psi).
- .3 Gaskets to be Cranite pre-formed asbestos, or approved equivalent in accordance with B7.
  - .1 Site or shop cut gaskets unacceptable.

## **2.4 VALVES**

- .1 Valves up to 50 mm (2") size - Toyo 5044A and Kitz Code No. 58 ball valve or Newman Hattersley 1969F. Newman-Milliken 200M, lubricated screwed plug valve, or approved equivalent in accordance with B7.
- .2 Valves 64 mm (2-1/2") and larger: Newman-Milliken 201M flanged plug valve. Newman-Milliken 200M, lubricated screwed plug valve, or approved equivalent in accordance with B7.

## **2.5 FLEXIBLE PIPING**

- .1 Flexible stainless steel tube with brass fittings with non-metallic cover.
- .2 Certifications: IAPMO, cUL Listed, CSA
- .3 Acceptable Product: Trac Pipe, or approved equivalent in accordance with B7.

## **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 GENERAL**

- .1 Run piping as shown to serve equipment. Take out permits and connect equipment ready for use. Provide gas regulators as specified under Products section of this specification. Run vent piping from relief valves to atmosphere. Install gas piping in accordance with Provincial Inspection and Technical Services regulations. Provide gas cock at each piece of equipment. Provide drip pockets at each piece of equipment and at low points. Grade horizontal piping 1:500 (1" in 40 ft.) to drain through risers.

### **3.3 PIPING**

- .1 Install in accordance with applicable Provincial/Territorial Codes, CAN/CSA B149.1, supplemented as specified.
  - .1 .

### **3.4 VALVES**

- .1 Install valves with stems upright or horizontal unless otherwise approved by the Contract Administrator.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

### **3.5 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

- .2 Manufacturer's Field Services:
  - .1 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
  - .2 Schedule site visits to review work at stages listed:
    - .1 After delivery and storage of products, and when preparatory work on which work of this section depends is complete, but before installation begins.
    - .2 Upon completion of work, after cleaning is carried out.
- .3 Obtain reports within 3 days of review and submit immediately to the Contract Administrator.

### **3.6 ADJUSTING**

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.
- .2 Pre-start-up Inspections:
  - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
  - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

### **3.7 CLEANING**

- .1 Cleaning: in accordance with Section 01 74 00 - Cleaning and Waste Management.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies the products and installation of cast and copper drainage systems.

**1.2 RELATED REQUIREMENTS**

- .1 Section 22 05 00 - Common Work Results for Plumbing
- .2 Section 22 07 00 - Plumbing Insulation

**1.3 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM B32, Standard Specification for Solder Metal.
  - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
  - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .3 CAN/CSA-B125.3, Plumbing Fittings.

**Part 2 Products**

**2.1 CAST IRON PIPING AND FITTINGS**

- .1 Cast iron piping:
  - .1 Above and below ground: Class 4000 to CAN/CSA-B70.
- .2 Cast iron joints:
  - .1 Above ground:
    - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70.
    - .2 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

**Part 3 Execution**

**3.1 INSTALLATION, TESTING AND PERFORMANCE VERIFICATION**

- .1 Provide complete systems of sanitary drainage and venting to serve all fixtures and equipment. This includes local drains from equipment in contract such as fan units, pump bases, etc.
- .2 Coordinate flashing of vents through roof with roofing subtrade.
- .3 Refer to Section 22 05 00 Common Work Results for Plumbing.

**END OF SECTION**



**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies the materials and installation of plastic drainage systems.

**1.2 RELATED SECTIONS**

- .1 Section 22 05 00 - Common Work Results for Plumbing
- .2 Section 22 07 00 - Plumbing Insulation

**1.3 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
  - .2 ASTM D2564, Standard Specification for Solvent Cements for Poly Vinyl-Chloride (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA B181.1-06 ABS
  - .2 CAN/CSA B181.2-06 PVC
  - .3 CAN/CSA-Series B1800, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Safety Data Sheets (SDS).

**Part 2 Products**

**2.1 PIPING AND FITTINGS**

- .1 Piping, fire rated: (secondary drainage systems)
  - .1 38 mm to 300 mm (1½" to 12") PVC/DWV: to CSA B181.2, CAN/ULC S102.2,
  - .2 Flame spread rating: less than 25
  - .3 Smoke developed classification: less than 50.
  - .4 Acceptable Manufacturers: IPEX
    - .1 Or approved alternate in accordance with B7.
- .2 PVC solvent weld:
  - .1 CSA certified
  - .2 Cements and primers to pipe manufacturer's recommendations.

**2.2 EXPANSION JOINTS**

- .1 Vertical:
  - .1 Provide vertical expansions joints form the same manufacturer as the piping.
- .2 Horizontal:
  - .1 EBAA Iron horizontal expansion joint for PVC Drainage, Waste and Vent systems

- .1 Or approved alternate in accordance with B7.
- .2 Match pipe line sizes.

**Part 3 Execution**

**3.1 INSTALLATION, TESTING AND PERFORMANCE VERIFICATION**

- .1 Provide complete systems of storm drainage to serve all fixtures and equipment.
- .2 Coordinate flashing of vents through roof with roofing subtrade.
- .3 Refer to Section 22 05 00 Common Work Results for Plumbing.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies the materials and installation for plumbing specialties and accessories.

**1.2 RELATED SECTIONS:**

- .1 Section 22 05 00 – Common Work Results for Plumbing

**1.3 REFERENCE**

- .1 American Society for Testing and Materials International (ASTM).
  - .1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA).
  - .1 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.
  - .2 AWWA C701, Cold Water Meters-Turbine Type for Customer Service.
  - .3 AWWA C702-1, Cold Water Meters-Compound Type.
- .3 Canadian Standards Association (CSA International).
  - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Safety Data Sheets (SDS).
- .5 Plumbing and Drainage Institute (PDI).
  - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
  - .2 PDI-WH201, Water Hammer Arresters Standard.

**1.4 SUBMITTALS**

Refer to section 01 33 00 – Submittal Procedures

**Part 2 Products**

**2.1 ROOF DRAINS**

- .1 RD-1 (Conventional drain)
  - .1 Body:
    - .1 Enamel coated cast iron
    - .2 Minimum size: 305 mm (12")
    - .3 Flashing clamp device
    - .4 Under deck clamp
    - .5 Pipe size as noted on the drawings
  - .2 Dome strainer:
    - .1 114 mm (4.5") high self-locking aluminum

- .3 Provide deck extensions to suit deck height.
- .4 Standard of acceptance: Zurn Z121-NH-ZA-C-E-R
  - .1 Or approved equivalent in accordance with B7.
- .2 RD-2 (Conventional drain with external water dam)
  - .1 Body:
    - .1 Enamel coated cast iron
    - .2 Minimum size: 381 mm (15")
    - .3 Adjustable extension: 35 mm (1.38") adjustability
    - .4 Flashing clamp device
    - .5 Under deck clamp
    - .6 Pipe size as noted on the drawings
  - .2 Dome strainer:
    - .1 114 mm (4.5") high self-locking aluminum
  - .3 Provide deck extensions to suit deck height.
  - .4 External water dam
    - .1 51 mm (2") high external water dam
  - .5 Standard of acceptance: Zurn Z100-NH-ZA-C-E-EA-R-89
    - .1 Or approved equivalent in accordance with B7.

## 2.2 CLEANOUTS

- .1 Line Cleanout Plugs: heavy cast iron male ferrule with gas and watertight tapered thread bronze plug.
  - .1 Access Covers:
    - .1 Wall Access: nickel-bronze, secured, square, smooth wall access cover and frame.
    - .2 Floor Access: Provide floor cleanout specified in 2.2.2 below.
  - .2 Floor Cleanouts: access cover with round top. Epoxy coated cast iron body, provide clamping collar(s) to match floor finish requirements.
  - .3 For PVC piping, use manufacturer cleanout caps with gasket.

## 2.3 SANITARY VENT TERMINATION

- .1 Body:
  - .1 Aluminum
  - .2 Minimum height 305 mm (12")
  - .3 Flashing flange
  - .4 EPDM upper seal and base seal
  - .5 Insulated vertical section with urethane foam
  - .6 Diameter to match existing vent termination. Contractor shall site confirm height and diameter prior to demolition of existing vent pipes.
- .2 Removable cap:
  - .1 51 mm (2") high removable cap
  - .2 Stainless steel screws securing to stack
- .3 Standard of acceptance: Thaler SJ-26
  - .1 Or approved equivalent in accordance with B7.

**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 data sheet.

**3.2 INSTALLATION**

- .1 Install in accordance with Manitoba Plumbing Code and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

**3.3 ROOF DRAINS**

- .1 Check security, removability of dome.
- .2 Clean out sumps.
- .3 Verify provisions for movement of roof systems.

**3.4 CLEANOUTS**

- .1 Install cleanouts at rainwater leaders, at locations required code, and as indicated.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

**3.5 SANITARY VENT TERMINATION**

- .1 Coordinate flashing of vents through roof with roofing subtrade.
- .2 Provide flashing or water proof membrane clamps on drains in floors.

**3.6 TESTING AND ADJUSTING**

- .1 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .2 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies the common work results for HVAC work.

**1.2 APPLICABILITY**

- .1 This section shall be applicable to division 22 through to and including division 23.

**1.3 REGULATIONS**

- .1 Comply with, most stringent requirements of National Building Code and local regulations and by-laws, with specified standards and codes and this specification. Before any Work is proceeded with, approved layouts to be filed with and approved by proper authorities.
- .2 Provide necessary notices, obtain permits and pay all fees, in order that work specified may be carried out. Charges and alterations required by authorized inspector of any authority having jurisdiction, to be carried out without charge or expense to the City. Pay all charges for service connections to municipal mains.
- .3 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

**1.4 LIABILITY**

- .1 Install work in advance of concrete pouring or similar work. Provide and set pipe sleeves as required.
- .2 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to the City.
- .3 Protect and maintain work until building has been completed and accepted. Protect work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of work, without expense to the City.
- .4 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets. Mount portable fire extinguishers in welding or soldering areas.
- .5 Co-ordinate work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all Contract Drawings.
- .6 On completion of work, remove tools, surplus and waste material and leave work in clean, perfect condition.

**1.5 ENGINEERING OBSERVATIONS**

- .1 The term "Mechanical Engineer" in all mechanical sections of specification shall mean:

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- .2 Contractor's work will be observed periodically, solely for purpose of determining general quality of work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and specifications to assist him to carry out work. Observations and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with all relevant codes, standards, plans and Specifications, nor does it impose upon the City, and/or the Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.
- .3 The Mechanical Engineer is not responsible for inspection of the Contractor's work. The Mechanical Engineer maintains the right to observe the work at its sole discretion. In addition to the above, Contractor's work will be observed by the City, and/or the Contract Administrator or their representatives, without notice or without request from Contractor.
- .4 Contractor shall notify the Contract Administrator of completion of work at various stages. Notification shall be made as a minimum as noted below where mechanical work is involved (provide a minimum of seven (7) Calendar Days notice), whereupon the Contract Administrator may visit site to periodically observe the work.
- .5 Where observation reports are submitted, the Contractor is responsible for rectifying issues noted in the Observation Reports in a timely manner and before covering up the work or affecting access to it.

## **1.6 SUBMITTALS**

- .1 Refer to section 01 33 00 – Submittal Procedures

## **1.7 MISCELLANEOUS APPARATUS AND APPLIANCES**

- .1 Make all required mechanical connections (direct or indirect) to devices, equipment, and appliances furnished by other trades or the City, as indicated or implied on the drawings or in the Specifications.
- .2 Verify mechanical connection requirements of all equipment prior to rough-in. Report any discrepancies to the Contract Administrator immediately. Revise pipe/duct size, and configurations as required to accommodate the mechanical service characteristics of the equipment supplied by other trades or the City.
- .3 Provide all required mechanical fittings, connections, and components to ensure proper and complete installation.
- .4 Install all devices and components shipped loose with equipment/appliances for field installation.
- .5 Coordinate with supplier, installer, other trade, and/or the City to ensure a proper and complete installation.

## **1.8 FLASHING**

- .1 Where pipes or ducts go through a roof or wall, they should be boxed-in and flashed. Allow for expansion and contraction of pipe. Flashing shall be waterproof.

## **1.9 WASTE MANAGEMENT AND DISPOSAL**

- .1 In accordance with Specification Section 01 74 00 - Cleaning and Waste Management.

**1.10 CO-ORDINATION WITH OTHER DIVISIONS, TRADES, AND CONTRACTORS**

- .1 Divisions 22 and 23 shall ensure that they read this specification and the associated drawings in conjunction with the following:
  - .1 The building Drawings and Specifications.
  - .2 The structural Drawings and Specifications.
  - .3 The phasing Drawings produced by the Contractor.
- .2 Subcontractors working under Divisions 22 and 23 are responsible for co-ordination of their work with all other trades and subcontractors, including those listed above, through the Contractor. Working through the Contractor, these divisions are responsible for ensuring that the installation of their work is co-ordinated with all other trades and contractors to mitigate interference issues between these trades and other Contractors on site.
- .3 Divisions 22 and 23 shall attend regular co-ordination meetings including pre-installation conferences with the general contractor and other relevant parties. Refer to building specification.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

**3.2 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**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 REFERENCES**

- .1 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.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

### **1.3 SUBMITTALS**

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

## **Part 2 Products**

### **2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Provide manufacturer's nameplate on each piece of equipment.
  - .1 Provide manufacturers' registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.
  - .2 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
  - .3 Lettering and numbers raised or recessed.
  - .4 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 Provide equipment I.D. tag minimum size 87mm x 32mm x 2.3mm (3-1/2" x 1-1/2" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6mm (1/4") high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.
- .3 Identify as follows: equipment type and number (e.g. pump no. 2), service or areas or zone building served (e.g. south zone chilled water primary).

## 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 or white anodized aluminum, 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.

## 2.3 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
  - .1 Natural gas: to CSA/CGA B149.1 authority having jurisdiction.

## 2.4 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 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .3 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.
- .4 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.

- .2 Length to accommodate pictogram, full length of legend and arrows.
- .3 Pipe in unexposed areas to be painted in accordance with listed colouring and labelling specifications.
- .5 Materials for background colour marking, legend, arrows:
  - .1 In areas exposed to view (i.e. mechanical spaces, rooms without ceilings, etc.):
    - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
    - .2 Other pipes: pressure sensitive plastic-coated cloth 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.
  - .2 In areas unexposed to view (i.e. above GWB or tile ceilings, etc.):
    - .1 Use black stencilled letters (e.g. "Chilled Water Supply", "Domestic Hot Water Supply") with arrow indicating air flow direction.
    - .2 Distance between markings 15m (50') maximum.
    - .3 Identify pipes on each side of dividing walls or partitions and beside each access door.
    - .4 Stencil only over final finish.
    - .5 Prior to installation, review general application of identification with Consultant.
    - .6 Colours: black, or co-ordinated with base colour to ensure strong contrast.
- .6 Colours and Legends:
  - .1 Where not listed, obtain direction from City's Representative.
  - .2 Colours for legends, arrows: to following table:

|                    |                 |
|--------------------|-----------------|
| Background colour: | Legend, arrows: |
| Yellow             | BLACK           |
| Green              | WHITE           |
  - .3 Background colour marking and legends for piping systems:

| Contents       | Background colour marking | Legend   |
|----------------|---------------------------|----------|
| Storm Drainage | Yellow                    | SWD      |
| Sanitary       | Green                     | SAN      |
| Plumbing vent  | Green                     | SAN. VTA |

**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 and or CSA registration plates as required by respective agency.

### **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 equipment rooms, 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 CLEANING**

- .1 In accordance with 01 74 00 – Cleaning and Waste Management.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                DESCRIPTION**

- .1            This section specifies the thermal insulation requirements for HVAC ductwork.

**1.2                REFERENCES**

- .1            American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1            ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2            American Society for Testing and Materials International (ASTM)
  - .1            ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  - .2            ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3            ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4            ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .5            ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3            Canadian General Standards Board (CGSB)
  - .1            CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2            CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4            Manufacturer's Trade Associations
  - .1            Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .5            Underwriters' Laboratories of Canada (ULC)
  - .1            CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2            CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3            CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
  - .4            CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

**1.3                DEFINITIONS**

- .1            For purposes of this section:
  - .1            "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2            "EXPOSED" - will mean "not concealed" as defined herein.
  - .3            Insulation systems - insulation material, fasteners, jackets, and other accessories.

- .2 TIAC Codes:
  - .1 CRD: Code Round Ductwork,
  - .2 CRF: Code Rectangular Finish.

#### **1.4 SHOP DRAWINGS**

- .1 Refer to section 01 33 00 – Submittal Procedures
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

#### **1.5 MANUFACTURERS' INSTRUCTIONS**

- .1 Installation instructions to include procedures used, and installation standards achieved.

#### **1.6 QUALIFICATIONS**

- .1 Installer: specialist in performing work of this section, and have at least 5 years successful experience in this size and type of project, qualified to standards.

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

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

### **Part 2 Products**

#### **2.1 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

#### **2.2 INSULATION**

- .1 Acceptable Manufacturers: Manville, Fibreglas, Knauf
  - .1 Or approved equivalent in accordance with B7.
- .2 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .3 Thermal conductivity ("k" factor) not to exceed specified values at 24oC mean temperature when tested in accordance with ASTM C335.
- .4 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .5 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to ASTM C553.

- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to ASTM C553.

### **2.3 JACKETS**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: Compatible with insulation.
- .2 Aluminum:
  - .1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: Stucco embossed.
  - .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
  - .5 To be installed on all outside ductwork.

### **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor vapour retarder finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC listed canvas jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor vapour retarder mastic:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
- .6 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting
- .8 Canvas adhesive: washable.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation one face of insulation with expanded metal lath on other face.
- .12 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.



**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENTS**

- .1 Pressure testing of ductwork systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

**3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
  - .2 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm spacing in horizontal and vertical directions, minimum two rows each side.

**3.3 DUCTWORK INSULATION SCHEDULE**

- .1 Insulation types and thicknesses: Conform to following table:

|                                                                                          | TIAC Code | Vapour Retarder | Thickness (mm) |
|------------------------------------------------------------------------------------------|-----------|-----------------|----------------|
| Outside air ducts                                                                        | C-1       | yes             | 50             |
| Exhaust or relief duct 3,000 mm inside building from wall penetration or damper location | C-1       | yes             | 50             |

- .2 All ductwork located outdoors shall be clad with aluminum jacket.
- .3 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
  - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

- .1 Finishes: Conform to following table:

|                                        | TIAC Code   | TIAC Code |
|----------------------------------------|-------------|-----------|
|                                        | Rectangular | Round     |
| Indoor, concealed                      | none        | none      |
| Indoor, exposed within mechanical room | CRF/1       | CRD/2     |
| Indoor, exposed elsewhere              | CRF/1       | CRD/2     |
| Outdoor, exposed to precipitation      | CRF/3       | CRD/4     |
| Outdoor, elsewhere                     | CRF/4       | CRD/5     |

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies materials and installation of low-pressure metallic ductwork, joints and accessories.

**1.2 RELATED SECTIONS:**

- .1 Section 23 01 00 – Common work Results for HVAC

**1.3 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A480/A480M-03c, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
  - .3 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 96-01, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
  - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 In accordance with Section 01 61 00 Common Product Requirements
- .2 Protect on site stored or installed absorptive material from moisture damage.

**Part 2 Products**

**2.1 SEAL CLASSIFICATION**

- .1 Classification as follows:

| <u>Maximum Pressure Pa</u> | <u>SMACNA Seal Class</u> |
|----------------------------|--------------------------|
| 500                        | C                        |
| 250                        | C                        |
| 125                        | C                        |
| 125                        | Unsealed                 |

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
  - .3 Class C: transverse joints and connections made air tight with gaskets sealant. Longitudinal seams unsealed.
  - .4 Unsealed seams and joints.

## **2.2 SEALANT**

- .1 Acceptable Manufacturers: Duro-Dyne, 3M, Flexa-Duct, United, Bakelite
  - .1 Or approved equivalent in accordance with B7.
- .2 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

## **2.3 TAPE**

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

## **2.4 DUCT LEAKAGE**

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

## **2.5 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
  - .1 Rectangular: standard radius short radius with single thickness turning vanes  
Centreline radius: 1.5 times width of duct.
  - .2 Round: smooth radius five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm: with single thickness turning vanes.
  - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
  - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Transitions:

- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
  - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

## 2.6 FIRE STOPPING

- .1 Fire stopping material and installation must not distort duct.

## 2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

## 2.8 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
  - .1 Maximum size duct supported by strap hanger: 500.
- .2 Hanger configuration: to ASHRAE and SMACNA.
- .3 Hangers: black galvanized steel angle with black galvanized steel rods to ASHRAE and SMACNA following table:

| Duct Size<br>(mm) | Angle Size<br>(mm) | Rod Size<br>(mm) |
|-------------------|--------------------|------------------|
| up to 750         | 25 x 25 x 3        | 6                |
| 751 to 1050       | 40 x 40 x 3        | 6                |
| 1051 to 1500      | 40 x 40 x 3        | 10               |
| 1501 to 2100      | 50 x 50 x 3        | 10               |
| 2101 to 2400      | 50 x 50 x 5        | 10               |
| 2401 and over     | 50 x 50 x 6        | 10               |

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp.
  - .3 For steel beams: manufactured beam clamps:

## Part 3 Execution

### 3.1 GENERAL

- .1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE, SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.

- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

### **3.2 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Fresh air intake.
  - .2 From bottom of horizontal duct without longitudinal seams.
    - .1 Solder joints of bottom and side sheets.
    - .2 Seal other joints with duct sealer.
  - .3 Slope horizontal branch ductwork down towards hoods served.
    - .1 Slope header ducts down toward risers.
  - .4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and discharging to open funnel drain or as indicated.

### **3.3 SEALING AND TAPING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

### **3.4 LEAK TESTING OF AIR DUCTS**

- .1 Visual and audible checks for leaks that can be heard or felt under normal operating conditions.

**END OF SECTION**

**Part 1 General**

**1.1 DESCRIPTION**

- .1 This section specifies materials, accessories and installation for breechings, chimneys and stacks.

**1.2 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)
  - .1 UL 103 / ULC ORD C959 –Standard for Factory Built Low Heat Chimney
  - .2 UL 641 / ULC S609 –Standard for Type L Low Temperature Venting Systems
  - .3 UL 2561/ ULC ORD C959 –Standard for 1400°F (760°C) Factory-Built Chimneys
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B139, Installation Code for Oil Burning Equipment.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Safety Data Sheets (SDS).

**1.3 SUBMITTALS**

- .1 Submittal in accordance with 01 33 00 – Submittal Procedures
- .2 Shop Drawings:
  - .1 Indicate following:
    - .1 Product
    - .2 Methods of sealing sections.
    - .3 Methods of expansion.
    - .4 Details of thimbles.
    - .5 Bases/Foundations.
    - .6 Supports.
    - .7 Guy details.
    - .8 Rain caps.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements: work to be performed in compliance with the Canadian Environmental Protection Act (CEPA), the Canadian Environmental Assessment Act (CEAA), Transportation of Dangerous Goods Act (TDGA), and applicable Provincial regulations.
- .2 Certificates:
  - .1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

## **Part 2 Products**

### **2.1 CHIMNEY AND BREECHING**

- .1 Provide double wall positive pressure metal stacks.
- .2 Listed by Underwriter's Laboratories for continuous operation at 538°C (1000°F) and intermittent operation at 760°C (1400°F) in accordance with UL 103 and in compliance with NPFA 211.
- .3 Insulation: 25 mm (1") mineral wool between walls.
- .4 Inner liner: minimum 20 gauge Type 304 stainless steel.
- .5 Outer shell: minimum 24 gauge Type 304 stainless steel.
- .6 Vent shall be rated for:
  - .1 Continuous operation at 50mm (2") clearance for building heating appliance chimney
  - .2 Continuous operation at zero inch (0") clearance to non-combustibles.
  - .3 Venting negative, neutral, and positive pressure applications.
  - .4 Venting flue gasses from gas, liquid, and solid fuel fired appliances.
  - .5 Positive pressures up to 60 inches water column.
- .7 Provide all required accessories each bearing factory applied UL Label, including but not limited to supports, appliances connectors, drain fittings, and terminations.
- .8 Provide all required accessories each bearing factory applied UL Label including but not limited to:
  - .1 Ventilated roof penetration: ventilated roof thimble, flashing, and counter flashing.
  - .2 Double cone rain cap: conical rain shield with inverted cone, for partial rain protection with low flow resistance.
  - .3 Joints: Provide for each vent one at each change of direction or as suggested by manufacturer's installation instructions. Provide support. Anchoring by installer.
  - .4 Chimney drain: Existing.
  - .5 Chimney bottom assembly: Existing

### **2.2 ACCESSORIES**

- .1 Cleanouts: bolted, gasketed type, full size of breeching, as indicated.
- .2 Barometric dampers: single or double acting, 70% of full size of breeching area.
- .3 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA).
- .4 Expansion sleeves with heat resistant caulking, held in place as indicated.

## **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 - GENERAL**

- .1 Provide New roof terminations and connect to existing venting.
- .2 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .3 Install breechings with a minimum number of joints. Align accurately at connections with internal surfaces smooth.
- .4 Suspend breeching at 1.5 m centres and at each joint.
- .5 Support vertical vent at 12 foot spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC duct Construction Standards – Metal and Flexible for equivalent duct support configuration and size.
- .6 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney.
- .7 Install flashings on chimneys penetrating roofs, as indicated.
- .8 Install rain caps and cleanouts, as indicated.
- .9 Breeching shall slope up to chimney and shall offer no restriction to flow. Provide long sweep elbows. On forced draft breeching provide cleanout at boiler.
- .10 The vent connector rise from each piece of equipment shall be the maximum possible to enhance flue gas venting.
- .11 Inner pipe joints shall be sealed by use of vee bands and silicone sealant for flue gas temperatures up to 315°C (600°F) and high temperature sealant for flue gas temperatures above 315°C (600°F) as outlined in the installation instructions and supplied by the manufacturer.
- .12 Install breechings from building structure, rigidly with suitable ties, braces, hangers, and anchors to hold to shape and prevent buckling.
- .13 Install concrete inserts for supporting vent in coordination with formwork.
- .14 Clean breeching and chimney during installation, removing dust and debris.
- .15 At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings or chimneys.
- .16 Locate chimney minimum of 907mm (3'-0") above highest point of roof including any project and/or rooftop mounted equipment within 3m (10'-0") horizontal from chimney, unless higher chimney is noted on drawings.
- .17 All parts exposed to the outer atmosphere that are fabricated from aluminized steel shall be protected by a minimum of one base coat and one finish coat of paint, such as series 4200-4300 Heat Resistant paint manufactured by Rust-O-Leum Corporation, or approved equivalent in accordance with B7. Paint to be supplied and applied by the installing contractor
- .18 Provide guy wire support as noted or as recommended by manufacturer.
- .19 Venting system diameter shown on drawings represents a minimum size only. Mechanical Contractor shall provide adequately sized venting systems, including all vent



connections, breeching, vents, chimneys, rain caps and other associated components, for all fuel fired equipment. Sizing of venting systems shall be determined to suit fuel fired equipment and vent system provided and shall meet requirements of vented equipment manufacturer and vent system manufacturer. In case of a variance in requirements between the two manufacturers, the larger size shall be used. Manufacturer's sizing calculations shall be submitted to the Contract Administrator for review. Performance deficiencies related to inadequate vent sizing shall be corrected at no additional cost to the City.

### **3.3 CLEANING**

- .1 In accordance with 01 74 00 – Cleaning and Waste Management.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**