
PART 1 - GENERAL

1.1 Related Sections

- .1 Section 02 41 21 - Demolition of Structures.
- .2 Section 06 10 10 - Rough Carpentry.
- .3 Section 07 62 00 - Sheetmetal flashing and Trim.
- .4 Section 07 92 00 - Joint Sealants.

1.2 References

- .1 American Association of Textile Chemists and Colorists (AATCC):
 - .1 AATCC 127-2008, Test Method - Water Resistance: Hydrostatic Pressure Test.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B32-08, Standard Specification for Solder Metal.
 - .2 ASTM B370-09, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .3 ASTM E84-10, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .4 ASTM E96/E96M-05, Standard Test Methods for Water Vapor Transmission of Materials.
 - .5 ASTM E907-96(2004), Standard Test Method for Field Testing Uplift Resistance of Adhered Membrane Roofing Systems.
- .3 Copper Development Association (CDA):
 - .1 Copper in Architecture Handbook, latest edition.
- .4 Canadian Standards Association (CSA):
 - .1 CSA-B111-1974(R2003), Wire Nails, Spikes and Staples.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
- .6 Society for Protective Coatings (SSPC):
 - .1 SSPC-Paint 12 1982, Paint Specification No. 12: Cold Applied Asphalt Mastic (Extra Thick Film).

1.3 Single Source Responsibility

- .1 Engage a single Subcontractor to assume undivided responsibility for the following work:
 - .1 Rough carpentry work associated with the roofing work, including installation of board insulation, specified in Section 06 10 10.
 - .2 Sheet copper roofing specified herein.
 - .3 Sheet copper flashing and trim specified in Section 07 62 00.

1.4 Submittals

- .1 General: Submit each item in this Article according to Section 01 30 00 - Submittal Procedures.
- .2 Shop drawings showing manner of forming, joining, and securing copper roofing, and pattern of seams. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.

- .3 Samples: Submit duplicate 100 mm x 100 mm samples of sheet copper material.
- .4 Product Data:
 - .1 Submit copper manufacturer's and fabricator's specifications, installation instructions, and general recommendations for roofing applications.
 - .2 Submit product data sheets for underlayment material. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Limitations.
 - .3 Include certification or other data substantiating that materials comply with requirements.
 - .4 Submit two copies of WHMIS MSDS Material Safety Data Sheets in accordance with Section 01 35 29 - Health and Safety Requirements for the underlayment material and for sealant material. Indicate VOC content.

1.5 Environmental Requirements

- .1 Comply with the requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous material; and regarding labelling and the provision of Material Safety Data Sheets.

1.6 Quality Assurance

- .1 Industry Standard: Except as otherwise shown or specified, comply with the applicable recommendations and details of CDA "Copper in Architecture Handbook". Conform to dimensions and profiles shown.
- .2 Wind Uplift: Provide roof assemblies meeting requirements of ASTM E907 for Class I-90 wind uplift resistance.

1.7 Field Samples and Mock-Ups

- .1 In accordance with Section 01 45 00 - Quality Control, construct a portion of copper roofing including materials and methods of fabrication and installation identical with project requirements. Provide a mock-up of sufficient size and scope to show the typical pattern of seams, fastening details, edge construction, and finish texture and colour.
- .2 Locate where directed by the Departmental Representative.
- .3 The accepted mock-up may be incorporated into the finished work.
- .4 The accepted mock-up shall be the standard of acceptance for the work of this Section.

1.8 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Use the least toxic sealants, and adhesives necessary to comply with requirements of this section.
- .7 Identify hazardous and related materials which cannot be reused, are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from the Provincial Ministries of Environment and Regional Levels of Government.
- .8 Close and seal, tightly, all partly used sealant and adhesive containers and store protected in well ventilated, fire-safe area at moderate temperature.
- .9 Place used hazardous sealant tubes and adhesive containers in areas designated for hazardous materials.
- .10 Collect, package and store sheet metal cut-offs and waste for recycling and return to recycler in accordance with Waste Management Plan.
- .11 Safely store materials defined as hazardous or toxic waste, including emptied containers and application apparatus, in containers or areas designated for hazardous waste and dispose of contaminants in an approved legal manner.

PART 2 - PRODUCTS

2.1 Materials

- .1 General: Except as specifically indicated as the work of another trade, provide components required for a complete roof system, including trim, copings, fascias, ridge closures, clips, seam covers, flashings, gutters, louvres, sealants, gaskets, and closure strips. Match materials and finishes of roof.
- .2 Copper roofing sheets: Copper sheet: to ASTM B370, H00 temper designation, 2% yield strength for roofing, 060 temper designation for flashing 6.10 kg/m² minimum weight, 0.68 mm thick.
- .3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .4 Underlayment: Air barrier membrane as follows:
 - .1 3 layer, Spunbonded polypropylene breather membrane
 - .2 Nonswelling, rot and mildew resistant.
 - .3 Nominal weight 170 g/m².
 - .4 Nominal thickness 0.6 mm.
 - .5 Water vapour transmission (ASTM E96 Method A): 119 perms.
 - .6 Hydrostatic Pressure, BS EN 20811: 7160 mm
 - .7 Surface burning characteristics (ASTM E84):
 - .1 Flame spread: Class A.
 - .2 Smoke Developed: Class A.
- .5 Fasteners:
 - .1 Rivets: 3.2 mm to 4.8 mm diameter, with solid copper mandrels and washers.
 - .2 Other fasteners to suit site conditions as recommended by installer to the approval of the Departmental Representative.

- .6 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .7 Accessories for flashing include cleats, wedges, washers and other accessories required to perform work. Ensure all such accessories are compatible with adjacent materials.
- .8 Solder: to ASTM B32, Grade Sn50, 50/50 tin/lead.
- .9 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.
- .10 Sealants:
 - .1 Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
 - .2 Joint Sealant: One-part silicone rubber sealant as recommended by the copper sheet manufacturer. Refer to Section 07 92 00 - Joint Sealants.

2.2 Fabrication

- .1 Shop-fabricate work to the maximum extent possible, to configurations indicated on the reviewed and accepted shop drawings, as required by site conditions, and in accordance with the applicable requirements of CDA "Copper in Architecture Handbook" and other recognized industry practices.
- .2 Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrate.
- .3 Comply with material manufacturer's instructions and recommendations for forming material.
- .4 Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- .5 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.
- .6 Hem exposed edges on underside 12 mm, mitre and seal.
- .7 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .8 Fabricate nonmoving seams in copper sheet with flat-lock seams. Form seams, and solder. Rivet joints for additional strength where necessary.
- .9 Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with mastic sealant (concealed within joints).
- .10 Where movable, non-expansion-type joints are indicated or required for proper performance of work, form copper to provide for proper installation of elastomeric sealant, in compliance with CDA standards.
- .11 Provide for separation of copper from noncompatible metal or corrosive substrate by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by the manufacturer/fabricator. Apply coating to both faces of dissimilar metals in contact.

PART 3 - EXECUTION

3.1 Preparation

- .1 Clean surfaces to receive copper roofing. Substrate to be smooth and free of defects. Drive all projecting nails or other fasteners flush with substrate.

3.2 Workmanship

- .1 Except as otherwise shown or specified, comply with recommendations and instructions of the copper sheet manufacturer and conform to the reviewed and accepted shop drawings.
- .2 Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal.
- .3 Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
- .4 Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
- .5 Conceal fasteners and expansion provisions where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- .6 Separate dissimilar metals by painting each metal surface in area of contact with a heavy coat of bituminous coating.
- .7 Use concealed fastenings except where approved by the Departmental Representative before installation.

3.3 Underlayment

- .1 Handle underlayment carefully to prevent tears and punctures and repair with adhesive tape any which does occur.
- .2 Install underlayment parallel to eaves with the black side up, maintaining consistent tightness.
- .3 Head (horizontal) laps to be not less than 100 mm and end laps of not less than 150 mm. Laps shall run with the flow of the water in a shingling manner.
- .4 Fasten top edge of each strip with corrosion-resistant stainless steel screws with a minimum 10 mm diameter washer. Use sufficient fasteners to hold underlayment in place until copper roofing is applied.
- .5 Lap underlayment over hips and ridges.
- .6 Lap underlayment 100 mm over metal valleys or built-in gutters.

3.4 Copper Roofing Installation

- .1 Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings and other components of copper roofing to profiles, patterns and drainage arrangements shown and as required for permanently leakproof construction.
- .2 Provide for thermal expansion and contraction of the work, as indicated. Seal joints as shown and as required for leakproof

construction. Shop-fabricate materials to greatest extent possible.

- .3 Secure cleats with two fasteners each and cover with cleat tabs.
- .4 Stagger transverse seams in adjacent panels.
- .5 Flash roof penetrations with material matching roof panels, and make watertight.
- .6 Form seams in direction of water-flow and make watertight.
- .7 Perform soldering with well heated coppers, heat seam thoroughly and sweat solder through its full width.
- .8 Clean and flux metals before soldering.
- .9 Follow sheet metal manufacturer's recommendations for soldering procedures.
- .10 As work progresses, neutralize excess flux with 5% to 10% washing soda solution, and thoroughly rinse. Leave work clean and free of stains.
- .11 Separate sheet metal cut-offs and damaged material from non-recyclable waste and dispose of at proper recycling facility.

3.5 Sealant-Type Joints

- .1 Where sealant-filled joints are used, embed hooked flanges of joint members not less than 25 mm into sealant. Form joints to conceal sealant completely.
- .2 When ambient temperature is moderate at time of installation, 4oC to 21oC, set joint members for 50% movement either way. Adjust setting proportionately for installation at higher ambient temperatures.
- .3 Do not install sealant-type joints at temperatures below 4oC.
- .4 Comply with the requirements of Section 07 92 00 - Joint Sealants for handling and installing sealants.

3.6 Flat Seam Roofing

- .1 Use 6.10 kg/m² copper, 0.68 mm thick rectangular sheets, to make flat seam roofing. Notch corners and turn up pretinned edges 20 mm.
- .2 Lock cleats into seams and flatten smooth in direction of flow.
- .3 At eaves and gable ends, terminate roofing by hooking over previously installed edge strip.

END OF SECTION

PART 1 General

1.1 INTENT

- .1 Copper flashing is intended to match visually the original flashing with improvements in the quality and gauge of material, and specific details.
- .2 Where necessary, modest detail changes have been designed to permit the new installation to visually appear similar to the original. Some on site adjustments to the details, which will not change the overall scope of work, may be made to ensure that the new flashing in no way detracts from the heritage character of the building.
- .3 No attempt is made to pre-patinate the flashings. It is the intent that all natural materials weather naturally.

1.2 DESCRIPTION OF WORK

- .1 Removal and replacement of copper flashings in designated construction area.
- .2 Flashing areas which fall within the work area, but which are not specifically detailed shall be duplicated exactly same for the means and methods of seaming which shall be done to the specifications herein.
 - .1 Consult with Departmental Representative to determine final arrangements of flashings in undetailed area and produce shop drawings for review prior to fabrication.

1.3 WORK INCLUDED

- .1 Sheet metal work in
 - .1 Copper
- .2 Sheet metal flashings
 - .1 Cap flashings
 - .2 Coping flashings
 - .3 Roofing flashings and fittings
 - .4 Drip flashings
 - .5 Door sill flashings
- .3 Miscellaneous roof work
 - .1 Stripping existing roofing

1.4 RELATED SECTIONS

- .1 Section 04 03 07 - Heritage : Masonry Repointing and Repair

- .2 Section 04 03 08 - Historic: Mortaring
- .3 Section 04 03 41 - Historic: Repair of Stone
- .4 Section 04 03 42 - Historic: Replacement of Stone
- .5 Section 04 03 43 - Historic: Dismantling stone Masonry
- .6 Section 04 05 00 - Common Work Results for Masonry

1.5

REFERENCES

- .1 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B36/B36M-06 Standard Specification for Brass Plate, Sheet, Strip, And Rolled Bar
- .3 ASTM B32-04 Standard Specification for Solder Metal
- .4 ASTM B370-03 Standard Specification for Copper Sheet and Strip for Building Construction
- .5 GSA Specification A-A-1925A (US Government Standards) - Anchors
- .6 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
- .7 American Welding Society Publication No. 120/2, Welding, Soldering, Brazing and Surfacing of Copper and Copper Alloy.
- .8 Atlas Stainless Steels, Technical Data Handbook, 1984.
- .9 Copper Development Association, Sheet Copper Application
- .10 CSA 123.3-M-No.15 - Asphalt saturated Organic Roofing Felt.
- .11 CSA B111-1974 (2003) - Wire nails, spikes and staples

1.6

DEFINITIONS

- .1 Sheet metal work:
 - .1 Cap flashings: Sheet metal carried over flashings and capped over the wall or let into the abutting wall to prevent water entering behind the flashings.
- .2 Copper Thicknesses:
 - .1 The thickness of the sheet copper has been identified on the drawings and specifications in metric measurement. Thicknesses are as follows:
 - .1 4.88 kg/m2.
 - .2 6.10 kg/m2.
 - .3 7.33 kg/m2.

1.7 SYSTEM DESCRIPTION

- .1 Performance Requirement:
 - .1 Workmanship will be of highest quality, conforming to the best traditional practice and shall be to the full satisfaction of the Departmental Representative.

1.8 SUBMITTALS

- .1 Product data:
 - .1 Adhesive membrane
 - .2 Samples:
 - .1 Before stripping extensive flashing, carefully remove, salvage and tag all typical sections of moulding and decorative metal work including but not limited to the following:
 - .1 Three representative samples of each existing cap flashing type.
- .2 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures
 - .2 Provide plans, elevations and plan sections and vertical sections to clearly explain the existing conditions.
 - .3 Provide full scale detail drawings of joints in the metal and detail sections showing the method of fastening the metal and identifying the substrate.
 - .4 Clearly show the relationship of elements to the adjacent materials, so that it is possible to determine the different functions of the connections.
 - .5 Reference the location of each of the samples of sheet metal work required.
 - .6 Where information is extrapolated or assumed, note it accordingly on the drawings.
 - .7 Drawing and final samples to be fabricated to a tolerance of 2mm.
 - .8 Record measurements in metric units, in millimeters only.
 - .9 Use micrometers, calipers, profile gauges and steel measuring tapes to confirm dimensions.
 - .10 Prepare the documentation using standard computer aided recording and drafting techniques.
- .3 Document the typical conditions of the selected elements and also the variations that occur on different, but similar elements.
- .4 Provide shop drawings for the following roof elements

- .1 Cap flashings
- .2 Coping flashings
- .3 Drip flashings
- .4 Door sill flashings

1.9 QUALITY ASSURANCE

- .1 Mock Ups:
 - .1 Provide mock ups in accordance with the requirements of Section 01 33 00- Submittal Procedures.
 - .2 Provide job site mock-ups of the typical sections of the sheet metal work before commencing the installation.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Packing and Shipping:
 - .1 Keep original labels intact on materials until reviewed.

1.11 STORAGE AND PROTECTION:

- .1 Protect metal from staining, abrasion of finish, bending and denting.
- .2 Protect roofing felt and wood products from moisture gain.
- .3 Store rolls of roofing felt and membranes on-end to prevent flattening and store at a minimum temperature of 21 degrees C for minimum 24 hour before use.

1.12 SITE CONDITIONS

- .1 Environmental Requirements
 - .1 Maintain roof substrate dry before applying roofing felt.
 - .2 Maintain air and surface temperature above 4 degrees C for 48 hours before and during installation of roofing felts and membranes.

PART 2 Products

2.1 SHEET METAL MATERIALS

- .1 Copper sheet: to ASTM B370 Alloy C11000 light cold-rolled copper.
 - .1 Weight 4.88kg/m2, 6.10kg/m2, 7.33 kg/m2
 - .2 Solder: 50% pig lead - 50%pure block tin alloy, conforming to ASTM B32.
 - .3 Flux- rosin type

- .4 Screws, fittings, clippings, clips, cleats and the like: shall be of non-ferrous material conforming to ASTM B36; Alloys number C11000, Copper, number C23000, red-brass, number C51000, Phosphor-bronze; Number C52100; Phosphor- bronze; number C65100, Silicon Bronze.
- .5 Nails for copper metal work: large flat-head nails, barbed no. 12 size of either alloy C11000 copper or alloy C23000 red-brass.
Length: to penetrate substrate 22mm unless otherwise noted.
- .6 Rivets: flat head solid brass 6mm diameter.
- .2 Fasteners and Anchors:
 - .1 Use fasteners and anchors of a type and size suitable for the particular fastening condition and service and as specified. Use only accepted anchors, nails, bolts, screws and other fasteners.
 - .2 Select fasteners so as not to project through substrate such as wood deck. Verify length of fasteners with Departmental Representative before installation.
 - .3 Rivets: pop rivets are not acceptable, use only solid brass rivets.
 - .4 Screws: round -head brass wood-screws and washers minimum no.12 size.
 - .5 Bolts: brass round-head type with nuts and washers as required, minimum 6mm diameter unless noted otherwise.
- .3 Felts and Adhesives
 - .1 Dry sheathing paper: rosin sized, unsaturated building paper weighing approximately 27 kg per 9.3 m².
 - .1 The dry sheathing paper is identified as a "separation sheet" on the drawings.
 - .2 7kg felt:
 - .1 Weighing minimum 6.8 kg per 9.3 m², organic fibre, asphalt-saturated roofing felt conforming to CSA A-123.6
 - .2 Roofing adhesives:
Plastic roofing cement: conforming to CGSB 37-GP-5M.
 - .3 Fasteners: Large head 32mm copper roofing nails.

2.2 FABRICATION

- .1 Metal work

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- .1 Fabricate all possible metal work in shop by brake forming, bench shearing, cutting, drilling and shaping.
 - .2 Provide accessories required for installation. Fabricate accessories of same material as work with which they will be incorporated unless otherwise noted.
 - .3 Hem all exposed metal edges at least 20mm.
 - .4 Fabricate the following from 6.10 kg/m² sheet copper.
 - .1 Cap flashings
 - .2 Copper flashings
 - .3 All metal work not fabricated from 4.88 kg/m² or 7.33 kg/m² copper
 - .5 Fabricate the following from 7.33 kg/m²:
 - .1 Cleats
 - .2 Continuous fastening strips
 - .3 Starter strips
 - .2 Forming:
 - .1 Form new metal work on a bending-brake. Shape trim and hand seam on the bench as far as possible, with the proper sheet metal working tools.
 - .2 Form bends with straight sharp lines, angles and arrises. Form sheets into true planes free from twists, buckles, dents and other visual distortions.
 - .3 Form rolls on wooden roll moulds to create a smooth profile matching the specified profile exactly. Broken curves are not acceptable.
 - .4 Form the angles of bends and fold or interlocking metal with full regard to expansion and contraction to avoid buckling or fullness in the metal after it is in service.
 - .3 Brake forming brass:
 - .1 Brake from hard tempered brass only after annealing to prevent fracturing.
 - .1 Heat evenly to 510-540 degrees C and allow to cool slowly to room temperature in air.
 - .4 Brazing:
 - .1 Conform to the requirements of the American Welding Society (AWS) Welding handbook: Welding Soldering, Brazing and Surfacing of Copper and Copper Alloys" Publication no. 120/2.
 - .2 For brass: use silver or copper phosphorus brazing alloys with type 3 flux.

2.3 SOURCE QUALITY CONTROL

- .1 Tests and reviews:
- .2 Provide affidavits warranting that materials meet required standards if requested by Departmental Representative

PART 3 Execution

3.1 INSTALLATION

- .1 Verification of conditions:
 - .1 Examine the areas and conditions affecting the work of this section.
 - .2 Notify Departmental Representative and obtain structural review of stripped masonry abutments and parapets.
 - .3 Notify Departmental Representative of unsatisfactory conditions and proceed only when corrected.
- .2 Preparation:
 - .1 Protection
 - .1 Be responsible for the repair and restitution of damage to the building caused by the work of this section.
 - .2 Maintain the roof and walls leakproof and weathertight as the work progresses.
 - .2 Stripping of existing flashings
 - .1 Salvage samples listed herein "samples" before stripping roof.
 - .1 Obtain representative sections of the original work which provide adequate information to accurately reproduce to original design.
 - .2 Tag and label samples and identify their origin on the heritage recording drawings and in photo record form before their removal.
 - .3 Remove debris and surplus material from site and dispose of properly.
 - .3 Surface preparation:
 - .1 Make surfaces to which finishes are to be applied smooth, clean, dry and free from wood rot or deteriorated masonry or any other defects that might adversely affect the installation.
 - .2 Cover knot holes or voids up to 20 mm in diameter with sheet copper nailed to deck.

- .3 Remove existing flashings, metal trim and deteriorated substrate.
 - .4 Punch down exposed nail heads 3mm minimum below surface of wood sheathing and blocking.
 - .5 Isolate all metal work from masonry and from roofing felt with a continuous layer of dry sheathing paper. Lay sheets of underlayment over the felt or masonry as the metal work proceeds to provide a bond breaker.
 - .6 Ensure that reglets cut into masonry by masonry trade are correct depth and full joint height at locations indicated on the drawings before proceedings.
- .3 Reglets:
- .1 Direct masonry trade to prepare reglets:
 - .1 Reglets are to be cut the full width of the joint.
 - .2 Minimum 38mm deep for copper flashings.
 - .2 Form metal to fit into reglets as follows:
 - .1 With an upstand $\frac{3}{4}$ of the width of the reglet at the back edge.
 - .2 To fit the full depth of the reglet.
 - .3 Secure with lead wedges at 300mm on centre.
 - .4 Apply backer rod as a bond breaker along the back of the reglet.
 - .5 Where sealant is shown on the drawings to fill the reglet, apply sealant as directed in Section 07 92 10-Joint Sealing:
 - .1 Sealant color to be selected by Departmental Representative.
 - .2 Tool sealant to a flush, slightly concave surface.

3.2 UNDERLAYMENT INSTALLATION

- .1 Roofing felt underlayment:
 - .1 Install 6.8 kg roofing felt underlayment over all substrates as detailed for metal flashing including masonry, wood and concrete to form secondary weather barrier.
 - .2 Install and lap felts to shed water.
 - .3 Secure felt with nails at 300mm centres and at 100mm on horizontal joints and 300mm on centre on vertical joints.
 - .4 Turn up edges of felts 100mm at vertical surfaces unless shown otherwise. Trim to straight edge.

- .5 Lay dry sheathing paper(separation sheet) as the work progresses in small sheets over all felt and adhesive membranes as a bond breaker to prevent contact with metal.

3.3 COPPER INSTALLATION

- .1 General:
 - .1 Install flashings and sheet metal work dead level, true to line and square. Fit work to existing building exactly.
 - .2 Install sheet metal work to prevent entry of water under service and weather conditions.
 - .3 Fasten work with weather-tight fasteners, evenly spaced and neatly located.
 - .4 Install sheet metal work with concealed fasteners. Obtain acceptance from Departmental Representative before proceeding when unable to provide concealed fasteners.
 - .5 Hem all exposed edges 20mm unless otherwise detailed.
- .2 Dissimilar metals
 - .1 Do not place copper in direct contact with any other type of metal other than lead or accepted lead plugs or washers.
 - .2 Make concealed fasteners and clips of the same metal as the flashings.
 - .3 Place a sheet of no. 6 sheet lead between copper and iron or steel to minimize galvanic action where contact is inevitable. Use stainless steel fasteners at these connections.
 - .4 Painting of surfaces to provide galvanic protection is not acceptable.
- .3 Cleats
 - .1 Fasten sheet metal to substrate with suitably sized cleats.
 - .2 Use fasteners and cleats of the same metal as the flashings.
 - .3 Fabricate cleats from metal one size larger than the metal it supports.
 - .1 For 6.1 kg copper, use 7.33 kg cleats.
 - .4 Fabricate cleats 50mm x 75mm to 100mm spaced 300mm o/c unless otherwise specified.
 - .5 Secure one end of cleat with two fasteners and fold back over fastener heads. Lock free end of cleat into seam or into folded edge of copper sheet.

- .1 Use large head copper roofing nails on wood substrate.
 - .2 Use light duty anchors on masonry substrate.
- .4 Tinning: Tin all edges of plain copper sheets to be soldered for a width of 40mm both sides with solder.
- .5 Soldering:
 - .1 Gently close clinch-locked joints and seams with a block of wood and mallet, then flux and fill with molten solder. Use sufficient heat to induce the solder to flow by capillary and create a waterproof joint.
 - .2 Perform soldering slowly with well heated coppers, so as to heat thoroughly the seam and sweat the solder through its full width.
 - .3 Wipe clean all exposed joints, wash immediately after the joints are soldered to remove all traces of solder and flux. Wash all copper work with soapy hot water upon completion.
- .6 Seams:
 - .1 Finish standing seams 25mm high unless noted otherwise.
 - .2 Finish flat-lock seams 20mm wide.
 - .3 Finish soldered lap seams 30mm wide, and rivet 40mm to 50mm o/c with 3mm rivets.
 - .4 Finish non soldered lap seams 30 mm wide, and rivet 40 to 50mm o/c with 3 mm rivets.
 - .5 Install seams in the direction of water flow.
- .7 Jointing:
 - .1 Flat lock and seam solder the following locations:
 - .1 Horizontal or sloped joints at a gradient of less than 1:5
 - .2 Where indicated on the drawings
 - .2 Make vertical joints watertight by forming with standing seams. Use soldered lock seams for internal corners. Use locked standing seams for external corners.
 - .3 Join cap flashings with concealed flat-locks.
 - .4 Provide slip-locked seams equally spaced at a maximum of 1200 mm on centre.
 - .5 Refer to the drawings for connection design. Do not change connection design without prior acceptance from Departmental Representative.
- .8 Starter strips:

- .1 Provide where metal extends over edges and where necessary to secure sheet metal work at eaves, gables, rakes, cornices and elsewhere.
- .2 Form starter strips of metal in continuous butted lengths to allow metal work to be hooked or dressed over not less than 20mm unless specifically detailed otherwise on the drawings.
- .3 Secure to the building with fasteners set 200mm on centre.
 - .1 Use light duty anchors at masonry.
 - .2 Use large head copper nails at woodwork.
- .4 Keep anchors back 50mm from masonry edges to prevent spalling.
- .9 Drip Edge
 - .1 Make drip edge to profile shown on drawings.
- .12 Door Sill
 - .1 Profile to match existing.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 04 21 13 - Brick Masonry

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.

1.3 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 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, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
 - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: person specializing in fire stopping installations with 5 years experience, approved by manufacturer.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative, Departmental Representative and Consultant 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.
- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

- .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
- .2 Twice during progress of Work at 25% and 60% complete.
- .3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN- ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: 2 hours, UL Design SP445.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

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 datasheets.

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through all masonry and concrete walls.
 - .2 Top of fire-resistance rated masonry separating renovated, occupied spaces and vent tower shafts.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .5 Openings and sleeves installed for future use through fire separations.

- .6 Around mechanical and electrical assemblies penetrating fire separations.
- .7 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .8 Miscellaneous existing openings in vent tower masonry walls. Assume a total of 50 randomly located 150mm diameter openings other than penetrations required by piping and conduit indicated.

END OF SECTION

PART 1 - GENERAL

1.1 Related Requirements

- .1 Section 07 61 00 - Sheetmetal Roofing
- .2 Section 08 11 00 - Historic Metal Faced Door Conservation
- .3 Section 08 50 10 - Historic Window Conservation
- .4 Section 09 21 16 - Gypsum Board
- .5 Section 09 22 16 - Non-structural Metal Framing

1.2 References

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C 919-02, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 Action and Informational Submittals

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions to include installation instructions for each product used.

1.4 Quality Assurance/Mock-Ups

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up to show location, size, shape, depth and adhesion

of joints complete with back-up material, primer, caulking and sealant. Allow for four mock-ups on different substrates.

- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.5 Delivery, Storage, and Handling

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .6 Unused material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

- .9 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 Site Conditions

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 Environmental Requirements

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

PART 2 - PRODUCTS

2.1 Sealant Materials

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

2.2 Sealant Material Designations

- .1 Type 1: One-component polyurethane.
 - .1 To CAN/CGSB 19.13-M87.
- .2 Type 2: Acrylic Latex One Part.
 - .1 To CAN/CGSB-19.17.
- .3 Type 3: Acoustical Sealant.
 - .1 To ASTM C 919.
- .4 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50%.
 - .2 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 Sealant Selection

- .1 Perimeters of exterior openings where hollow metal frame meets exterior facade of building (i.e. stone): Sealant type: 1.
- .2 Perimeter of copper (i.e. roof, flashing) where copper element meets exterior stone surface: Sealant type: 1.
- .3 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant type: 2.
- .4 Perimeter of interior hoarding: Sealant type: 3.

2.4 Joint Cleaner

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

PART 3 - EXECUTION

3.1 Protection

- .1 Protect installed Work of other trades from staining or contamination.

3.2 Surface Preparation

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 Backup Material

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 Mixing

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 Application

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.

- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION